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# TRAUMATIC DIAPHRAGMATIC HERNIA

## A Case Report

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THE subject of diaphragmatic hernia in all of its aspects has been covered so exhaustively in the literature in recent years that I shall not bore you with any discussion of symptomatology, diagnosis or management. Harrington,[1] Strayer[2] and others have reported series. The case to be presented has been selected not because it is by any means unique but because it represents quite well several phases of traumatic diaphragmatic hernia from the standpoint of both diagnosis and management.

On April 3, 1950, F. H. A., a young male aged 24, was referred by Dr. H. A. Brocksmith of Tulsa, Okla., with a diagnosis of left, traumatic type, diaphragmatic hernia. The history indicated that in March, 1942, when the patient was 16 years old, his left chest was run over by a rear wheel of a heavy oil field truck. The lad was given emergency treatment for pain and shock but was not hospitalized. A diagnosis of fracture of three ribs of the left side of the thorax was made. The patient returned to full activities in about one month and reported for high school in September of the same year. At that time his only complaint was inability to eat a full meal without upper abdominal distress and an occasional feeling of "gurgling" in his left chest. These complaints were dismissed by his medical attendant as of no consequence without further investigation.

During the years following this at high school the young man was very active athletically. He was a regular member of the football,

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basketball and baseball teams. He recalled no impairment of his ability to execute any form of physical exertion required while a participant in these sports. Following his graduation from high school, basketball and "softball" continued to occupy much of the spare time from his period of training as a mechanic.

In the period following the injury until Dr. Brocksmith was consulted, the lad sought relief from four different physicians. His complaints continued to be an uncomfortable sense of upper abdominal and lower chest fullness after anything but a small meal and frequent gurgling about his heart and left chest. The conclusion reached by each attendant was "neurosis" and apparently sedatives, antacids, and anti-spasmodics constituted the sole treatment beyond reassurance. Among the examinations was that of an induction board in 1944 which rejected the patient but made no comment on his chest x-ray.

In the six months period preceding consultation with Dr. Brocksmith the sense of discomfort following all food intake was increased and the gurgling in the chest became more constant and annoying. At no time was there nausea or vomiting and bowel function was normal. There were no episodes of acute pain and no reference to the back or shoulder regions of any discomfort experienced. Full employment as a mechanic doing active but light work continued.

On the basis of this history and the physical findings of a bizarre pattern of dullness and tympany over the lower left chest to percussion, peristaltic noises and splashes high in the left chest on auscultation, Dr. Brocksmith promptly made a tentative diagnosis of old left diaphragmatic hernia of traumatic origin. Fluoroscopy plus barium by mouth and by enema confirmed the diagnosis. The x-ray conclusions were to the effect that all of the stomach and part of the distal transverse colon and possibly the spleen had been displaced into the left pleural cavity. There was no shift of the mediastinum of consequence and cardiac contours were normal. The lung was compressed upward.

The patient's general condition was excellent with adequate hematologic findings, satisfactory serum protein and other blood chemistry and a normal electrocardiogram. Patient's general musculature was excellent and the patient's build powerful although spare. The very flat, hard muscled abdomen gave rise to some indecision as to surgical approach. After eight years it could be expected that the eventrated abdominal viscera had lost their right of abdominal tenure. On the other hand, extensive adhesions and a difficult diaphragmatic repair were almost certain to be encoun-

tered. Finally, individual preference dictated a thoracic approach and this was carried out.

On April 8, under endotracheal anesthesia of gas oxygen and ether left thoracotomy was performed through the eighth interspace, the incision extending from the sternum posteriorly to the posterior axillary line. Rib resection or facture was not necessary. The entire stomach and the transverse colon from its midpoint past the splenic flexure together with the spleen were found in the pleural cavity, the lung being compressed upward by these viscera. The spleen was approximately twice normal size. It perched upon a shelf of diaphragm and was held in place by fairly dense adhesions to the posterior parietal pleura as well as to the edges of the diaphragmatic tear. The transverse colon was adherent to the pleural surface of the diaphragm by well organized adhesions. The exact length and location of the diaphragmatic laceration could not be determined as yet because of the attached viscera and the marked tension of the muscle itself. Accordingly the phrenic nerve was crushed and the diaphragm promptly relaxed and at once through the laceration a large amount of small intestine herniated, approximately 90 cm. It required only a couple of futile attempts to replace the coils of small intestine to satisfy us that the abdomen would have to be opened to clear the thorax of abdominal viscera. Accordingly, without changing the patient's position a left mid paramedian abdominal incision was made and the eventrated small bowel withdrawn through the diaphragm and outside the abdomen also to be encased in hot packs. The relaxed margins of the diaphragmatic laceration could now be well defined. It extended from a point just to the left of the esophageal hiatus irregularly anteriorly to the thoracic wall for a distance of approximately 18 cm. Splenectomy was performed by securing the arterial supply first thus greatly decreasing the size and conserving considerable blood. It was thus possible to readily divide remaining adhesions and return the stomach and transverse colon to the abdomen. Closure of the diaphragmatic tear posed a problem. Despite the relaxation induced by the phrenic crush the segment in the central tendon indicated considerable tension would be present there. However, by imbricating the anterior and posterior extremities of the laceration strongly using heavy silk, the central tendon area was thus relaxed and so approximated nicely permitting even slight overlapping. Because the parietal pleura had been abraded in numerous areas, pleural cavity drainage seemed indicated, particularly since positive pressure expansion of the lung still did not permit it to completely fill the cavity. A simple underwater drain was provided. The small intestine and, by now, stomach and transverse colon, were returned to the abdomen

and closure accomplished with considerable difficulty employing interrupted silk sutures throughout. It appeared for a time it might be necessary to close the skin only and later repair the ventral hernia.

Convalescence was unexpectedly smooth as an ileus was feared. The patient was out of bed in 48 hours and the thoracotomy drain removed the fourth day. The abdomen appeared quite distended although bowel function and expulsion of flatus was adequate. This gave the principal discomfort. The left lung slowly expanded on breathing exercises but it was necessary on three occasions to perform thoracenteses to remove bloodstained fluid. The patient returned to his duties on June 1. The most recent follow up on September 18 disclosed a fully expanded left lung and intact diaphragm which is still paralyzed. The patient is completely symptom free and has returned to his former sports activities.

*Discussion:* There were several reasons for presenting this case. First of all an injury of the type received by this patient calls for a period of careful observation and investigation of the numerous possible serious consequences, among them ruptured spleen, traumatized kidney, etc., as well as diaphragmatic rupture. Second, an adequate investigation of a subject who continues to present such complaints—in this instance the history and physical examination alone were sufficient to almost clinch the diagnosis. Operating this patient as an elective case is a totally different problem from the standpoint of mortality, morbidity and management than had he developed an acute intestinal obstruction. It is almost miraculous that no complications developed in view of his very active life. Third, from the standpoint of management, it is apparent that laparotomy would have been required in this case as an adjunct to thoracotomy. The duration of the condition and the patient's heavily muscled almost scaphoid abdomen point to this. However, it would have been well to pack the area of the laceration as efficiently as possible before relaxing the diaphragm by phrenic crush to avoid further evisceration into the thorax and this will be done in the future. In this case it made no difference; it might in others.

Time does not permit the discussion even were it worth while of the relative merits of the abdominal and thoracic approaches. The experience and bent of the surgeon plus the conditions to be met determine this. The personal preference for thoracotomy is strong. The viewpoint of Dr. Jimmy Rives, warmly remembered by this essayist as an instructor then at Tulane, is shared. Quoting him, "Closing a diaphragmatic hernia through the abdomen is like shingling a roof from the attic."

The matter of phrenic crush has also been rather well settled. In

many instances it is obligatory. It has been shown that the muscular atony resulting from interference with nerve supply is not prejudicial to a persistently good diaphragmatic repair. Therefore when indicated it can unhesitatingly be performed.[3]

In conclusion, traumatic diaphragmatic hernia even in civilian life occurs with sufficient frequency to warrant its inclusion in our diagnostic possibilities. Its management like almost every condition met in surgery must be strongly individualized after the basic requirements incident to all good surgical care have been met.

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# THE SPLEEN, A FEW SURGICAL ASPECTS*

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AMONG the first successful splenectomies performed in America, one finds W. B. Powell's of Newport, Kentucky, in 1826. The year was memorable, as his fellow Kentuckian, Dr. Benjamin Winslow Dudley, of Transylvania Medical School, ligated the subclavian artery for aneurysm for the first time, and Valentine Mott of New York reported the first successful ligation of the common iliac artery. G. Volney Dorsey, of Piqua, Ohio, in 1855, did one of the first planned splenectomies in modern times, and was followed by Alston, a surgeon in the Confederate forces, at the battle of Perryville, Kentucky, in 1862. In the surgical history of the War between the States, 26 cases of operative removal of the prolapsing spleen are recorded.

Zaccarelli and Zambaccari, in 1549 and 1680, provided stimulation as to the feasibility of splenectomy which was revived by Kuechler in 1855 and Spencer Wells in 1866.

Both the concepts of and the indication for splenectomy have been in confusion for many years past. It has not been so many years since splenectomy was often done in many ill-defined conditions accompanied by splenomegaly. At present we know how fallacious was the reasoning, but it must also be remembered that many conclusions concerning the spleen and splenectomy have been the result of trial and error, as may be said of much in medicine. Empiricism, trial and error, have not as yet, unfortunately, been completely effaced by our modern era of antibiotics. But fortunately at present we have a few basic principles to guide us in some of our conclusions as to surgery of the spleen.

Many fanciful and mysterious functions have been ascribed to the spleen. The collected literature relative to these functions is enormous. Krumbhaar tritely remarks: "It is unfortunate that it has been so often clouded with immature conclusions from dubious results based on inadequate material."

It may be stated, without reservation, that during fetal life both leukocytes and erythrocytes are formed in the spleen, while the formation of lymphocytes, large mononuclear cells with other types of white cells continues in adult life. There is positive evidence that the spleen's erythrocytic production discontinues at birth.

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The defense mechanism of the spleen through lymphocytes and phagocytes in chronic wasting diseases of bacterial origin should be remembered. Phagocytic endothelial cells are agents, both for destruction and disposal of erythrocytes, thrombocytes, and parasitic foreign bodies.

Ebert and Stead found exercise produced an increase in the hemoglobin and volume of packed cells in both normal and splenectomized persons, and this was associated with a decrease in plasma volume. It has been observed that no change occurs in the total circulating red cells after heavy work by using radiophosphorus as a labeling agent.

From the work of Barcroft and Binet we have proof positive that the spleen stores quantities of blood for periods of emergency. The elasticity of the spleen, due to the large amount of smooth muscle in its substance, explains its activity in contraction. Drastic exercise, fear, hemorrhage, injection of adrenalin or pituitrin may initiate contraction. The spleen is one of the active blood reservoirs from which reserve blood may be forced into the circulation in time of drastic need.

It has only been in recent years that we have appreciated as one of the normal functions of the spleen its power of inhibition of the bone marrow. An understanding of this function has aided enormously in our knowledge of diseases affecting the spleen and also has made plausible some indications for splenectomy which heretofore were rather doubtful.

Many are of the opinion the spleen is involved in some disturbances of lipoid metabolism, in that its phagocytes store lipoid material not found in the blood, or present in abnormal amounts, such as kerasin in Gaucher's disease and cholesterol in Christian's disease.

With the parathyroids, the spleen probably influences calcium metabolism. Twenty per cent of the portal blood entering the liver comes from the spleen, thus, one must conclude that the increase in this volume in splenomegaly must alter hepatic function. The surgeon's concern in splenic functions rests on the relation of its removal to well-being. We may safely assume that all functions attributed to the spleen may be assumed adequately by other organs, except its capacity as a reservoir. Splenectomy is followed by: 1. A transient secondary anemia, leukocytosis and eosinophilia, which is slight, usually disappearing within 12 months. 2. An increased resistance of the red cells to hemolytic agents, formerly altered by a destructive splenic physiology. 3. A decrease in a tendency to jaundice, resulting from the bilirubin formed by the reticuloendothelial system reaching the liver in a dilute state from the

circulation and not in concentration from the portal circulation. 4. An increase in thrombocytes, thus reducing the clotting time.

A. Prigot and L. T. Wright are of the opinion that, "Severe or late effects on the health and well-being of the splenectomized person are negligible or absent."

The grave danger one encounters following splenectomy is postoperative thrombosis. In splenic anemia a high platelet count is thought to be a definite contraindication to splenectomy, for fear of splenic, portal, and mesenteric thrombosis. Portal thrombosis must be considered, should one encounter, postoperatively, severe prolonged abdominal pain, distention, increase in white blood and platelet counts with an elevated sedimentation rate. Anticoagulants may be useful as a preventive and in the therapy of this complication.

Briefly a few indications for splenectomy which have been in general use until recently are: (1) Injury or disease confined to spleen (abscess, neoplasm, and cysts), (2) Banti's disease, (3) Congenital hemolytic icterus, (4) Thrombocytopenia, and (5) Gaucher's disease.

The above indications have been expanded in the last few years largely because of increased knowledge relative to functions of the spleen.

A wandering or prolapsed spleen is by no means rare. It may be found in any location in the peritoneal cavity but usually favors the lower quadrant. A bizarre symptomatology is present. Complications, due to moderate torsion, may ensue, such as acute engorgement with subcapsular hemorrhage or necrosis. The diagnosis presents few difficulties, when palpation discloses the shape and notches with an ectopic position. Splenopexy is usually successful except in splenomegaly, when splenectomy must be substituted. The most serious complication, that of complete torsion with strangulation, demands immediate operative interference.

Rupture of the spleen may be spontaneous or the result of trauma (fig. 1). The former usually warrants a grave prognosis, the latter is always a serious abdominal catastrophe. Of the traumatic rupture, 50 per cent succumb within an hour of injury, and the majority within 24 hours, unless surgical intervention is instituted. A period of shock, followed by the usual signs of intraperitoneal hemorrhage, is noted. We have not found abdominal rigidity early although tenderness has been quite constant. Contrary to some opinions, we have found Ballance's sign to be frequent, depending on dullness in left flank which does not shift as a result of blood coagulation. Again, Kehr's sign, or hyperesthesia over left shoulder tip, often

referred to as omalgia, has been most valuable, although disregarded by some.

Spontaneous rupture may be a sequel of over-distention imposed on the soft spleen, of acute fevers, septic splenitis, malaria, typhoid fever, and a far larger number than one suspects, from subacute bacterial endocarditis. The history of an infection with the sudden appearance of symptoms, indicative of traumatic rupture, leads one to a diagnosis. As a rule, splenomegaly is demonstrable.

Immediate treatment of shock and a prompt splenectomy when shock is controlled should reduce the average mortality of 25 to 35 per cent to 10 per cent.

**Fig. 1. Rupture of spleen.**

Patient, aged 32, fell 30 feet striking sand. He showed signs of mild shock from which he recovered in a short time. On his admission to hospital two hours after the accident, definite signs of intraperitoneal hemorrhage were present. The signs of both Kehr and Ballance were positive with tenderness over the splenic area. The pulse was of poor volume and thready with blood pressure 86/41. Splenectomy was performed with removal of ruptured spleen (fig. 2) and 2000 cc. of blood from the peritoneal cavity.

Patient, aged 31, had been hospitalized four weeks with subacute bacterial endocarditis. He suddenly developed severe pain in left hypochondrium with shock and signs of intraperitoneal hemorrhage. Ballance and Kehr's signs were positive. Blood pressure 88/42; leukocytes, 20,500, with erythrocyte count of 3,000,000 and 50 per cent hemoglobin, pulse 130, thready and of poor volume. At operation a spontaneous rupture of spleen (fig. 3) with massive intraperitoneal hemorrhage was found.

There is no doubt that many small ruptures of the spleen, not involving the hilus and accompanied by slight hemorrhage, recover without being recognized, depending on two of nature's factors:

(1) the great omentum pursuing its well-known constabulatory role by plugging the rent; (2) a coagulum efficiently sealing a small disruption.

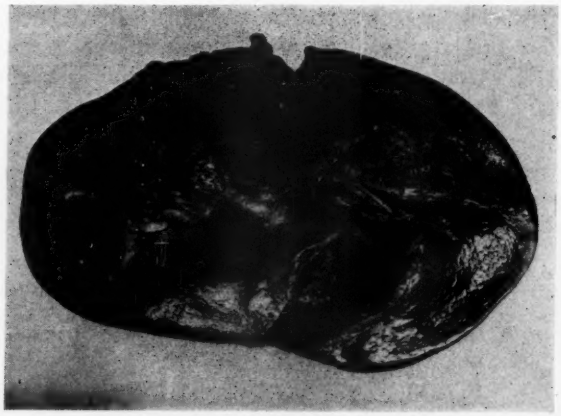

Fig. 2. Rupture of spleen into hilus.

We are convinced that conservative procedures, such as splenorrhaphy or packing of splenic lacerations, are unsafe, inadvisable, and frequently result in delayed hemorrhage and death. The mortality must necessarily remain high because of the high incidence of rapid exsanguination and associated injuries.

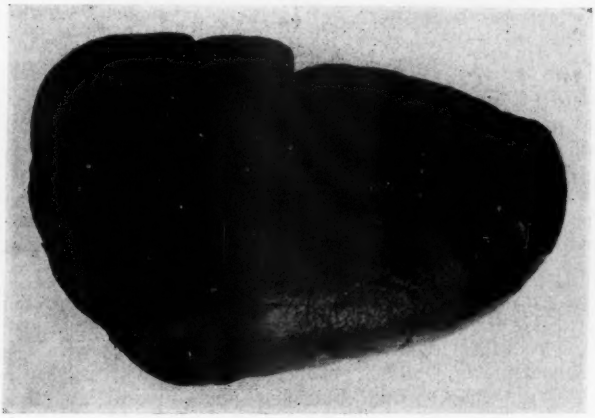

Fig. 3. Spontaneous rupture of spleen with infarction.

Abscesses of the spleen (fig. 4) usually result from: infected hematomas; septic infarcts occurring in bacterial endocarditis and septicemias; acute fevers of enteric origin, or by extension from con-

tiguous suppurative lesions. A septic fever with tenderness and pain in splenic area associated with the friction rub of perisplenitis should arouse our curiosity. Not more than 50 per cent are recognized, because the severity of the infection from which they result casts a shadow over the complication. Splenectomy is the treatment, provided general conditions warrant its employment.

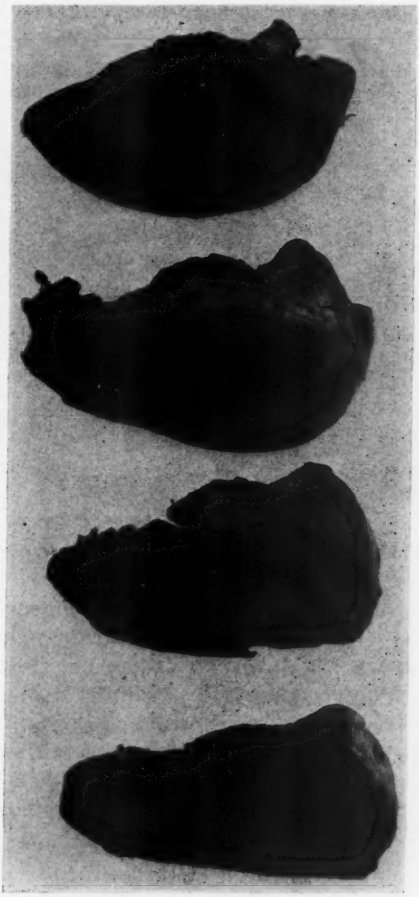

Fig. 4. Multiple abscesses of spleen.

Since splenic tuberculous infection is hematogenic, the infrequency of primary tuberculosis of the spleen (fig. 5) is striking, considering its abundant, although peculiar vascular arrangement. The lesion usually presents miliary tubercles on the surface with conglomerate tubercles or caseous masses throughout the organ. A

symptomless splenomegaly or a severe sepsis may be present, and at times, calcified areas are visualized by x-ray (fig. 6). Splenectomy offers the eradication of a large focus of reinfection, and may be indicated in any case of tuberculosis of the spleen, provided this disease is not active elsewhere in the body.

It might here be noted that calcification of the splenic artery is not rare and is often revealed in flat x-ray plates made as scout films, especially in elderly patients (fig. 7). An aneurysm of the splenic artery is at times revealed by a calcified sacculation which is easily visualized and on occasions additional signs may be present.

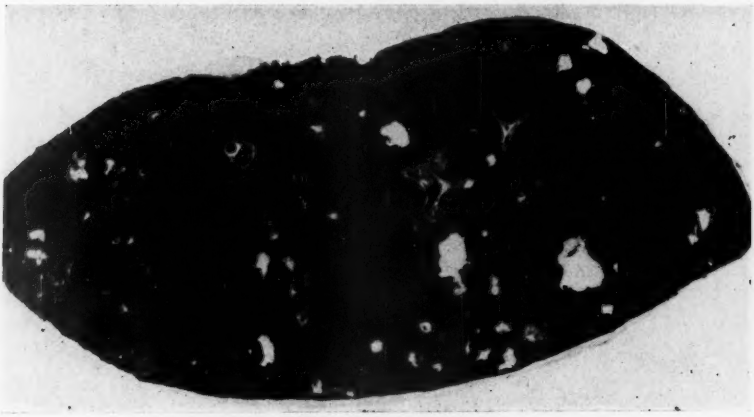

Fig. 5. Tuberculosis of spleen.

Splenomegaly may be a manifestation of congenital syphilis with enlargement of the liver and secondary anemia, the splenomegaly being only secondary to a spirochete invasion of the liver. At times, difficulty arises in distinguishing this condition from splenic anemia. A positive serologic test is presumptive evidence in favor of hepatosplenomegaly of syphilitic origin. There are few syphilitic patients who, after thorough antisyphilitic medication, possess a refractory splenomegaly requiring splenic extirpation to remove this focus of spirochete infection.

Malaria remains a causative factor in many enlargements. In chronic malarial splenomegaly, splenectomy may be advisable because of the danger of spontaneous rupture, prolapse or torsion, and the spleen remaining a reservoir for reinfection after partial control of the primary disease has been attained.

Splenic panhematopenia, though not common, may arise acutely or may be secondary to a pre-existing enlargement of the spleen. The condition is characterized by a striking decrease in the produc-

tion and maturation of the granulocytes, erythrocytes, and platelets and may be differentiated from aplastic or hypoplastic anemia by the finding of hyperplastic bone marrow. It would seem the spleen probably exerts an excess inhibition on the bone marrow in this condition. Splenectomy may improve the clinical state and prolong life, but if the disease is secondary to splenic enlargement one should not expect a beneficial influence on the primary lesion.

Splenectomy was first performed for Felty's syndrome in 1932 by Hanrahan and Miller. Much discussion has ensued, both because of the unknown primary source of the symptoms of the syndrome and its rarity. The manifestations are usually a chronic arthritis, splenomegaly, leukopenia and anemia.

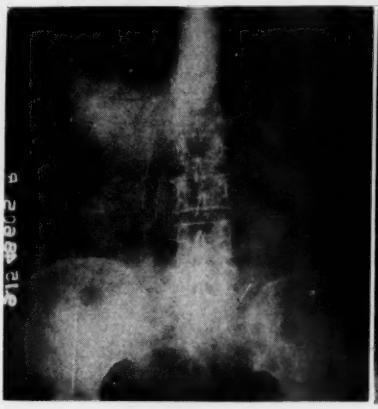

Fig. 6. Calcification of spleen.

Fig. 7. Calcification of splenic artery.

Primary splenic neutropenia probably represents a selective form of hypersplenism in which only one of the functions of the bone marrow is inhibited, that of maturation of the granulocytes, the primary manifestations of the disease being splenomegaly and neutropenia. Splenic excision is curative.

The manifold difficulties in the diagnosis of splenic anemia (figs. 8, 9, 10, 11) are well known, probably due to the undetermined etiology and the vagueness with which the term is used to cover a group of diseases, or shall we say, symptom complexes. The name Banti's disease, as used by some, is quite familiar and will stand until a more definite scientific knowledge supplants it with one more specific. The usual characteristics of splenic anemia are: pallor, weakness, anorexia and abdominal discomfort associated with splenomegaly. The degree of splenomegaly may be indicative of the amount of obstruction resident in the splenic or portal vein and

may offer some prognostic value. Anemia is the rule with a leukopenia. Portal congestion may be marked with varicosities of the coronary veins, accounting for the oft encountered hematemesis. Jaundice and ascites appear, at times, as terminal manifestation.

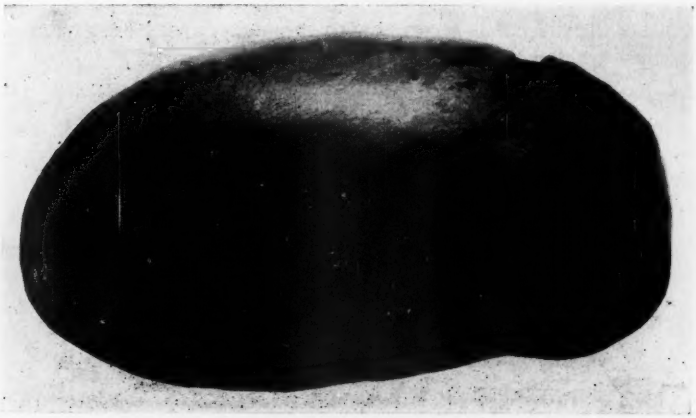

Fig. 8. Spleen of Banti's disease.

Splenectomy offers improvement in a great number of early splenic anemias. A large number have a plasma protein deficiency which should be corrected preoperatively. In those moderately advanced,

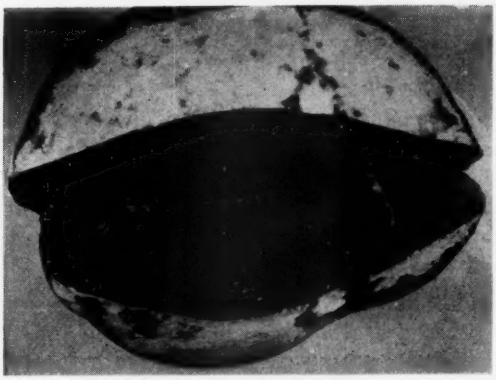

Fig. 9. Incised spleen Banti's disease.

a complementary ligation of the coronary veins should be considered to reduce the incidence of postoperative hematemesis. The benefit derived from splenic excision may have a physiologic basis by relieving the enormous blood burden imposed on an inadequate liver, occasioned by splenomegaly.

Patient, aged 34, female, was admitted to hospital with recurrent hematemesis. Two months previous to admission she received three blood transfusions for severe gastrointestinal hemorrhage. The spleen could be palpated with ease, extending into lower left quadrant of the abdomen, and firm in con-

**Fig. 10. Infarction of spleen. Splenic anemia.**

sistency. Erythrocytes, 2,000,000; hemoglobin, 15 per cent; leukocytes, 5,100. The urine contained bile pigments and urobilin. At operation a large spleen, consistent with Banti's disease, was removed followed by ligation of the coronary veins.

**Fig. 11. Close-up of splenic infarction.**

We are of the opinion that of all the theories advanced, Banti's relative to toxicity seems as unreasonable as others of equal empirical origin. As to cures, we are aware that a great number are not permanently cured by splenectomy, but a long period of relief ensues, giving ample justification for its use until a definite etiology and specific therapy are at hand.

In Banti's syndrome, a great number present an obstruction to the venous outflow, usually because of thrombosis of the splenic vein. This obtaining, a cure may be hoped for. However, if the portal hypertension is due to obstruction in the portal trunk or its branches, or if the portal hypertension is due to intrahepatic obstruction, splenectomy is without effect. In the presence of the last mentioned types of obstruction, the only hope one may have for its correction is the employment of one of the shunt operations, by anastomosing the splenic vein to the left renal vein, or the portal vein to the inferior vena cava. The latter have been rather disappointing to many surgeons, and are considered by some as surgery of desperation.

Fig. 12. Lymphosarcoma of spleen.

Thrombocytopenia purpura is a symptom complex with a constitutional tendency to hemorrhage. Clinically, one notes ecchymotic patches under the skin, bleeding from mucous surfaces as from the mouth, or gastrointestinal tract. The Dalldorf suction test or tourniquet test are usually positive. A low platelet count, nonretractile clot with a prolonged bleeding time, is the rule. In many, the Vitamin C concentration is low and should be supplemented with cevitamic acid. Low blood calcium does occur and should receive prompt attention. When conservative measures bring no relief and a normal or increased leucocyte count with a good reticulocyte response to hemorrhage are present with a non-retractile clot and increased bleeding time, splenectomy may be beneficial. When delay is not advisable, Doan, Curtis, and Wiseman counsel the use of repeated transfusions to minimize the danger of immediate splenectomy. Failures after removal of the spleen, denoted by recurrent hemorrhages, would seem attributable to accessory splenic tissue.

Congenital spherocytic hemolytic jaundice (Hemolytic icteroanemia) is associated with splenomegaly, erythrocytic fragility, anemia, jaundice, and spherocytosis. The anemia is caused by blood destruction from fragility of the red cells; jaundice occurs from the rapid formation of bile pigment from released hemoglobin; splenomegaly follows increased hemolysis in the spleen causing overactivity. The increased fragility is limited to the spheroidal microcytes. The finding of spherocytes in the blood is now deemed pathognomonic of the disease. As has been aptly stated, these patients seem more jaundiced than sick, an absence of itching is noteworthy. Cholelithiasis is often found in association or as result of the disease.

Fig. 13. Hemangio-endothelioma of spleen.

Splenectomy is definitely indicated, the symptoms are relieved as by magic, hemolysis is arrested but the spherocytosis and fragility remain. Preoperative transfusions are contraindicated because of hemolysis, but the preoperative injection of adrenalin should be used, resulting in the spleen delivering red blood cells into the circulation, truly an auto-transfusion.

Primary tumors of the spleen are not so rare as has been generally supposed. Benign tumors and cysts, such as hydatid or retention cysts, are found but are far outnumbered by lymphosarcoma (fig. 12), hemangioendothelioma (figs. 13 and 14), spindle cell sarcoma and secondary carcinoma. Pain with an increasing mass in left upper abdomen, progressive anemia and emaciation are suggestive of a malignant lesion.

It is amazing that the spleen is not the recipient of more frequent secondary malignant metastases when one considers the abundance

of lymphatic tissue which is constantly exposed to the vagary of carcinomatous cells through the large quantity of blood in the splenic reservoir. In comparison the liver is a much more common site for secondary growths. Why should the spleen be more resistant to secondary malignant invasion? One can only conjecture that some inherent immune factor plays an inhibitory role.

The operation of splenectomy is usually not a difficult procedure, but on occasions may tax the ingenuity of the surgeon. Its approach may be either abdominal or transthoracic, the former being more often employed. The ease of the procedure may be aided by adequate exposure and we have used a left upper transverse abdominal

Fig. 14. Cavernous Hemangio-endothelioma of the spleen.

incision and believe it efficacious, but find the conventional left long rectus incision more useful in the greater number of procedures upon the spleen. On delivery of the spleen, its fossa, especially the area bounded by the diaphragm above should be packed with a large hot sponge to control oozing until the splenic vessels are ligated and the spleen excised. The splenic artery and vein should be ligated separately except in extreme emergency. In ligating the gastric branches of the splenic artery, care must be exercised or the stomach may be injured, as also is the pancreas liable in blind pedicle ligation. Should the latter prevail, one need not be too concerned, as on several occasions a small portion of the tail of the pancreas has been inadvertently ligated with no deleterious effect.

It is not uncommon following splenectomy to find a mild febrile state continuing over a period of one week. This has been the subject of much discussion, as to explanation. Among the theories ad-

vanced the following are most plausible: (1) ligation of the pancreatic tail, (2) formation of exudate in the operative area, and (3) collection of blood in the splenic bed. One, or a combination of all, might be sufficient to explain adequately a mild postoperative fever.

The question of partial permanent disability following removal of the spleen as a result of trauma is constantly arising, based on the premise that its extirpation removes a reservoir of red cells, resulting in fatigue from strenuous exercise. This has not been proven by the careful study of a large number of splenectomized soldiers in World War II.

Splenectomy performed for thrombocytopenic purpura and congenital icteroanemia does not increase the hazards of pregnancy for either the mother or fetus, as many have supposed, despite the increased incidence of obstetric hemorrhage in this group of women. Where splenectomy has been performed for splenic anemia, the hazard of pregnancy for mother and fetus is distinctly increased above the normal risk, as noted by hepatomegaly with demonstrable fluid in the peritoneal cavity in many cases.

A word as to splenic puncture as a diagnostic procedure, since it has become more popular in the last few years. The procedure must be considered a risk, although its benefits may outweigh the risk in a large number of cases. The complication of intraperitoneal hemorrhage, of course, is most frequent and all patients following splenic puncture should have bed rest. We are of the opinion that a pronounced hemorrhagic tendency, a painful spleen and a septic splenomegaly are definite contraindications to splenic puncture as a method of obtaining splenic tissue for biopsy.

In conclusion, where splenectomy is contemplated by the surgeon the wise judgment of the medical practitioner and laboratory specialist should be welcomed in a coordinated plan of management.

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# OBSTRUCTION OF THE GASTROENTEROSTOMY STOMA DUE TO THROMBOSIS OF OMENTUM*

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WHILE reviewing the gastric resections done at the Latter-Day Saints Hospital (an open staff general hospital) from 1947 to 1949, it was noted that of 170 partial gastrectomies performed, five developed stomal obstructions during their postoperative convalescence. In studying these 5 cases, it was interesting to note that they had been operated upon by four different surgeons and that 3 of them had a very similar convalescent course. I would like to present these latter 3 case histories for further consideration.

CASE 1. A 61 year old male was admitted with a two year history of epigastric pain and sour eructations relieved by food and soda. For three weeks prior to admission, his pain had been constant. He also experienced episodes of vomiting and had passed three black stools. Physical examination was normal except for mid-epigastric tenderness. X-rays of the gastrointestinal tract revealed a duodenal ulcer with high grade obstruction at the pylorus and a retention of 60 per cent of the barium after four hours. The laboratory reported a hemoglobin of 11.2 Gm. (70 per cent) and a normal urinalysis. Two 500 cc. blood transfusions were given and on April 3, 1947, a retrocolic Polya gastric resection was performed. The operation was mechanically difficult because the duodenal ulcer had penetrated into the liver. A tube was left in the stomach for decompression. The early postoperative convalescence was uneventful; however, on the third postoperative day when the gastric decompression tube was clamped off and later removed, the patient became nauseated and vomited. The gastric decompression tube was then reinserted. The hemoglobin at this time was 15 Gm. (94 per cent) and the serum protein was 10.5 Gm. Because the efferent loop of the enterostomy failed to function, he was reexplored on the tenth postoperative day. At operation, everything appeared edematous, especially the omentum which was thick, hemorrhagic and adherent to all adjacent structures. These changes in the omentum were very striking and definitely more than is usually encountered at operations performed on the tenth postoperative day. Careful investigation of the anastomotic area showed it to be patent and anatomically correct. This was demonstrated by passing a gastric tube and an examining finger through the anastomosis. An enteroenterostomy was done between the efferent and afferent loops of the gastroenterostomy and a feeding jejunostomy of the Witzel type was established. Laboratory determinations repeated after surgery showed the serum proteins to be 8.12 Gm. and a hemoglobin of 14.2 Gm. (83 per cent). Nutrition was maintained by jejunostomy feedings. Despite the enteroenterostomy made between the afferent and efferent loops of the gastroenterostomy, he continued to vomit bile colored fluid unless decompressed by the stomach

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tube. Complete retention of the gastric contents was demonstrated by x-ray. A third laparotomy was performed 27 days after the first operation and 17 days after the second operation. Numerous adhesions were noted between the omentum and the site of the previous operation and between the omentum and the anterior abdominal wall. The omentum was still thick, edematous and hemorrhagic making the operation mechanically very difficult. The posterior gastroenterostomy was taken down and the opening in the jejunum closed. An anterior gastrojejunostomy of the Polya type was then done and the anastomosis pushed to the left, well away from the thickened and edematous omentum. The patient's convalescence was somewhat stormy, being complicated by renal decompensation (Blood Urea Nitrogen 51.8 mg. per cent) and by some consolidation in the bases of both lungs. However, he improved steadily and the new gastroenterostomy functioned satisfactorily. He was discharged two and one-half weeks after his third operation and has remained symptom free.

CASE 2. A 63 year old male hospitalized with a history of postprandial burning epigastric pain that had been present for approximately eight years. Despite some relief from medical and dietary management, he had been getting steadily worse. Two years previously, a gastroenterostomy had been performed without improvement. Recently he had noted spells of vomiting and the emesis contained food eaten six to eight hours earlier. His past history was essentially noncontributory with the exception of the fact that he had had a cholecystectomy 30 years before. On physical examination, tenderness was present in the right upper quadrant of the abdomen and in the epigastrium. Laboratory examinations revealed a normal urinalysis and a hemoglobin of 13.5 Gm. (84 per cent). X-rays of the gastrointestinal tract showed obstruction at the gastroenterostomy and in the duodenum. Also, there appeared to be an obstructed loop of small bowel adjacent to the gastroenterostomy. At operation, the old gastroenterostomy was taken down and a retrocolic Polya gastric resection performed. Numerous adhesions were encountered, making the operation mechanically difficult. The early postoperative convalescence was normal, in fact smoother than the average. The gastric decompression tube was removed on the third day and liquid feedings started. The patient was up out of bed and doing exceptionally well until the eighth postoperative day at which time he became apprehensive and complained of upper abdominal pain. The next morning he vomited approximately 500 cc. of bile colored fluid. A Levine tube was passed and an additional 1,000 cc. of fluid aspirated. His hemoglobin at this time was 13.5 Gm. (84 per cent), and the white blood cell count was 9,000 with a normal differential count. Aside from a chill which accompanied a plasma transfusion, his temperature had remained normal. The obstruction continued despite conservative treatment and on the nineteenth postoperative day he was reopened. The operator encountered a thickened indurated and hemorrhagic omentum which was adherent to the anterior abdominal wall, to the stomach and to adjacent tissue. These omental changes were striking and definitely unusual. No free fluid was encountered in the peritoneal cavity and no evidence of infection or abscess formation could be seen. The anastomosis was thoroughly examined and found to be patent. Because of the numerous adhesions in this area, it was felt safer not to disturb it so an anterior gastrojejunostomy was done with a jejunojejunostomy between the afferent and efferent loops. A feeding jejunostomy of the Witzel type was also established. The patient's course was somewhat stormy being accompanied by considerable abdominal distention and, despite two gastro-

jejunostomies, he continued to be obstructed. He vomited whenever the gastric depression tube was removed and his bowel movement remained acholic except when bile was injected through the feeding enterostomy tube. His nutrition was improved by jejunostomy feedings. X-rays taken 13 days after the last operation showed the barium to pass readily from the stomach into the adjacent jejunum and remained there for about one hour but by 24 hours it had passed to the terminal ileum. Regardless of this, the patient continued to lose through vomiting or aspiration, between 1,500 and 2,000 cc. of bile colored fluid per day. On the twenty-fifth day after the second operation, he was x-rayed again by injecting barium through the gastric tube. After one hour, the patient was so distressed that part of the barium had to be aspirated. X-rays taken at two hours showed that none of the barium had left the stomach. Serum proteins on three occasions were reported at 5.95 Gm. or better and his nutrition was maintained by transfusion and jejunostomy feedings. His hemoglobin remained around 16 Gm. (100 per cent). Because of continued obstruction, a third laparotomy was performed 28 days after his second operation. The omentum was bound to the anterior abdominal wall, to the first gastroenterostomy and to the adjacent small bowel. The second gastrojejunostomy was free as was the enteroenterostomy between the efferent and afferent loops of this anastomosis. The thickened edematous omentum was resected. The posterior gastroenterostomy was taken down and the opening in the stomach and jejunum closed. The stomach was then placed well to the left side of the abdomen and the incision closed. Pathological report on the resected omentum showed fibro-fatty tissue with collections of lymphocytes. Despite a small abscess, adjacent to the jejunostomy tube, the patient steadily improved, permitting hospital discharge 16 days after his last operation. He had no fever except after the third operation. His white count did not exceed 10,500 except after the last operation when he developed mild pulmonary congestion. He has remained well and free of gastric symptoms since.

CASE 3. A 65 year old male admitted with an eight year ulcer history who, for the last five years, had had progressive symptoms of obstruction. One and a half years prior to admission, he had a severe gastric hemorrhage. Repeated attempts with medical management were unsuccessful and so surgery had been recommended. His past history revealed a coronary occlusion five years before with some residual angina. Physical examination was negative and the laboratory reported a hemoglobin of 14 Gm. (87 per cent) and serum proteins of 7.70 Gm. with a normal urinalysis. After nine days of medical management, his obstruction continued, making operation necessary. A retrocolic Polya resection was done. At the conclusion of the operation, it was noted that the omentum was somewhat cyanotic and that there was thrombosis of some of the veins. It was felt, however, that the omentum was viable and the incision was closed. The patient's early convalescence was uneventful and the gastric decompression tube was removed on the third postoperative day. On the seventh postoperative day, he developed abdominal distress and vomited. The vomiting persisted unless the stomach was decompressed by a gastric tube. An attempt was made to pass a Cantor tube through the distal loop of the gastroenterostomy but this was unsuccessful. Because of continued obstruction of the efferent stomal loop, it became necessary to reopen him on his twelfth postoperative day. At operation, the omentum presented the outstanding pathology. It was thick, edematous, hemorrhagic and adherent to all the adjacent structures. There were no abscesses encountered and no free fluid

was present. The old posterior anastomosis was taken down and an anterior Polya resection done with a jejunojejunostomy between the afferent and efferent loops. The omentum was not resected. The patient's convalescence following this was uneventful and he left the hospital 10 days later. A clinical follow-up reveals that he has continued to improve.

## Discussion

In analyzing these 3 cases, it is to be noted that when the gastric decompression tube was removed on the third day, these patients had some distress but some or most of the stomach contents passed the anastomosis and then on the seventh or eighth postoperative day, complete or near complete obstruction developed. It is interesting to note that the surgeon's description of the findings at the second operation invariably described the omentum as edematous, thickened, firm, hemorrhagic and adherent to all adjacent structures. These changes in the omentum were more than those usually encountered after a recent laparotomy. It might be of some significance that all of these cases had retrocolic Polya type of operations. Whether a Hofmeister modification would have given the same result under similar conditions is hard to say. The exact cause of this syndrome is unknown to us but one would suspect either infection, nutritional hypoproteinemia, vascular disturbances or a combination of these as the underlying cause. Against infection, as the etiological agent, is the fact that the temperature in these cases never went over 100.4° F. rectally; no abscesses or free fluid were encountered at the second operation; the white blood cell count remained in normal limits and the report by the pathologist of tissue removed at surgery showed only a normal number of polymorphonuclear cells. Against nutritional hypoproteinemia and edema as the etiological agent is the fact that repeated serum proteins were in the normal level and the fact that blood transfusions were used generously in all cases.

It is our belief that interference with the blood supply to the omentum is the primary cause of this syndrome. This hypothesis was brought to our attention by the last case where at surgery it was commented that the omentum appeared cyanotic and that some of the veins were thrombosed. When this case followed the typical course outlined above and when findings at surgery were identical with the other cases, it was felt that omental ischemia might be the basis for this chain of events. In reviewing these cases, the surgeons were all impressed by the fact that the omentum was thick, edematous, adherent and hemorrhagic in appearance. Likewise, the pathological report of the omentum, when it was removed, was fibrous changes with round cell infiltration, changes that are com-

patible with ischemia. The fact that, in order to correct the condition, the retrocolic anastomosis must be converted into an anterior type of an anastomosis and placed well to the left side of the abdomen away from the area of this ischemic omentum, leads one to believe it plays a role in the obstruction. The anatomical arrangement of the blood supply to the omentum is such that in doing a gastric resection it is easy to injure it and produce a thrombosis of some of the vessels (fig. 1).

Drawn from Callander

Fig. 1. Illustration of the arterial blood supply to the greater omentum. The venous supply is practically identical and so is not illustrated. Note that the blood supply comes almost exclusively from the gastroepiploic vessels and that injury to these vessels will interfere with the omental blood supply.

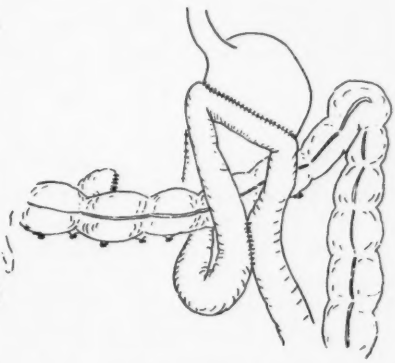

Fig. 2. This illustration is to show the relationships of the organs after corrective operation. The posterior gastrojejunostomy has been disconnected and an anterior gastrojejunostomy performed and the anastomosis placed well to the left side of the abdomen.

If one can assume that impaired circulation is the cause, then the condition can be avoided by either resecting the omentum with the stomach, as is recommended in cases of carcinoma, or by being cautious in dividing the vessels between the stomach and the gastroepiploic vessels. Certainly, if the omentum appears cyanotic at the conclusion of the operation it should be resected. When confronted with a patient showing early postoperative stomal obstruction and reoperation reveals an edematous adherent omentum, the corrective procedure or choice is to disconnect the posterior gastrojejunostomy and to do an anterior gastrojejunostomy and place it well over to the left side of the abdominal cavity (fig. 2). This may be done with or without resection of the omentum. When this procedure has been carried out, the results have been good. Lesser procedures such as jejunojejunostomy, freeing of adhesions about the anastomosis, etc., have all failed.

## Summary

In summary, 5 cases of postoperative gastric resection stomal obstructions have been reported, 3 of them in detail. Evidence has been present which makes obstruction of the vascular supply to the omentum the most likely etiological cause in these 3 cases. This complication can be avoided by taking care to preserve the blood supply of the omentum or by resecting it as is recommended in cases of neoplasm. If one encounters this complication, then the posterior gastrojejunostomy should be separated and an anterior gastrojejunostomy substituted and the anastomotic area placed well to the left side away from the area of inflammation.

# EXTERNAL ENDOMETRIOSIS, CLINICAL AND EXPERIMENTAL*

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EVER since Russell,[1] in 1899, first described endometrium in an ovary in the Johns Hopkins Gynecological Pathological Laboratory, we have been interested in the subject of external endometriosis. Since internal endometriosis or adenomyosis appears to be a separate pathological and clinical entity it will be excluded from this discussion.

One reason for our renewed interest in this disease is the fact that its incidence appears to be on the increase. Whether this is an apparent increase due to more frequent recognition or a real increase may be debatable. In a recent statistical study of our material covering a 15 year period from 1933 to 1947, inclusive, we found it to occur in 5.6 per cent of the laparotomies done during this period. The remarkable fact was that, whereas it occurred in only 3.2 per cent of the laparotomies in 1933, it was present in 9.0 per cent in 1947. The increased incidence was due entirely to an increase among the private patients. On the white and colored private wards the incidence remained practically constant throughout this decade and a half, whereas among the private and semiprivate patients the incidence increased from 7.5 per cent in 1937 to 21.6 per cent in 1947. In the year 1943, 25.2 per cent of the laparotomies done on private and semiprivate patients were performed for endometriosis. Inasmuch as these figures are from a clinic in which all tissue removed at the operating table from its inception has been subjected to microscopic study, it seems probable that this represents a true increase in the incidence of the disease.

One of the tragedies of this condition is that it frequently occurs in women who have not yet completed their families. The ravages of the disease or the surgery necessary for its eradication often sterilize these women or, worse still, in the more extensive cases may result in castration. Among the women operated upon primarily for endometriosis, 49 per cent were in their thirties and 32 per cent were in their twenties. In a few instances we encountered it before

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the age of 20. That sterility is high among patients with endometriosis has been repeatedly shown by several authors. In considering the sterility rate of this disease one should consider it in the light of the expected normal absolute sterility rate. Reynolds and Macomber[2] found this to be 12 per cent and Whelpon and Kiser[3] considered it to be 9.8 per cent. In our group there were 430 married women. Among these, 46 per cent were relatively sterile and 33.5 per cent absolutely so. These figures correspond very closely to those of Counseller[4] who reported an incidence of 48.9 per cent of relative sterility and 32.1 per cent of absolute sterility.

Abnormal uterine bleeding is considered by most authors as a prominent symptom of endometriosis. An incidence as high as 65 per cent has been reported. Our study would seem to indicate that this symptom has been given undue prominence. The reason for this is probably that associated lesions occur commonly with external endometriosis which may be responsible for the bleeding. If we eliminate the cancers, the myomas, the polyps and all uterine lesions which commonly cause bleeding we would estimate that not over 15 to 20 per cent of our cases were bleeding abnormally as a result of the endometriosis.

Lower abdominal pain and especially dysmenorrhea have been given consistently as the most prominent and characteristic symptoms of endometriosis. Acquired dysmenorrhea or dysmenorrhea of increasing intensity has been stressed so much that it is considered by some clinicians as pathognomonic of the disease. This has, in fact, led to many unnecessary operations upon women with negative pelvic findings but with "typical" histories of endometriosis. We cannot subscribe to operating upon such women for the findings at operation are all too frequently grossly normal. It is in such cases that we have found culdoscopy useful and we believe we have spared many a laparotomy by this simple procedure.

Among our 243 cases upon whom operation had been done primarily for endometriosis, dysmenorrhea was present in 79.8 per cent. However, in 51.4 per cent it had been present from the onset of menstruation and was unchanged or diminishing in intensity, while in only 9.3 per cent was there true acquired dysmenorrhea. It is noteworthy that in 16.5 per cent there was no menstrual pain. In this same group of patients 37.9 per cent had abdominal pain unrelated to menstruation. Thus abdominal pain associated or unassociated with menstruation remains the most common symptom of endometriosis, but it should not be lost sight of that even extensive endometriosis can be present quite painlessly.

Backache, pain in the rectum, rectal bleeding and dyspareunia

may be caused by endometriosis but they are relatively inconstant.

Endometriosis is a unique disease in that it is the only instance in all pathology in which adult benign tissue invades other tissue. This peculiar disease has intrigued gynecologists for many years, particularly as to its mode of origin. Russell believed that the endometrium that he found in the ovary was misplaced there embryologically. Such a theory does not appear to be capable of proof or disproof and in fact no one has thus far been able to substantiate it.

Halban[5] brought forth an attractive theory of dissemination of endometrial particles via the lymphatics. He believed that this was the one theory that would explain both internal and external endometriosis. The almost complete absence of endometriosis in pelvic lymph glands would seem to discredit this theory.

Sampson's[6] theory of retrograde menstruation caused great interest and found ardent supporters and opponents. The proponents of this theory cited the frequency of patent tubes in endometriosis and the geographical location of the endometrial implants on the ovaries and in the pelvis in such places as would seem most likely if they resulted from particles of viable endometrium dropping from the tubal fimbria. They also called attention to the fact that blood and endometrial tissue are sometimes found in the pelvis in patients operated upon during menstruation. To test this theory experiments were carried out whereby bits of endometrium were removed from the uterus and successfully transplanted into the peritoneal cavity. Endometrium was also successfully grown in tissue culture.

The theory most universally upheld by the opponents of Sampson's theory was that of Meyer and Iwanoff who believed that the aberrant endometrium represented metaplasia of the serosal epithelium. There was disagreement as to the cause of the metaplasia. Robert Meyer believed it to be inflammation. The paucity of endometriosis on our colored wards where pelvic inflammation is most common would cause one to question this etiology. Novak and Meigs believed the metaplasia to be on a hormonal basis but the exact basis of this hormonal mechanism has never been made clear. After all, the tissues of all menstruating women are subjected to hormonal influence and only a relatively small percentage acquire endometriosis. The proponents of the serosal metaplasia theory appear to use as chief evidence for their theory, arguments against Sampson's theory of retrograde menstruation. They cite the very small calibre of the tubal lumina at the uterine cornua, the relative infrequency of finding particles of endometrium in the tubes sectioned in the laboratory and the fact that transit of the endometrial particles would have to be against tubal peristalsis and the action of

the tubal cilia. But the greatest argument presented against Sampson's theory was the belief that the castoff menstrual endometrium was nonviable. They very properly pointed out that the experiments of transplanting endometrium were not applicable to supporting Sampson's theory since in all such experiments viable endometrium from the lower layers of the endometrium was included in the transplanted tissue. Novak has stated that if it could be shown that menstrually desquamated endometrium is capable of growth, Sampson's theory would be greatly strengthened. Sampson[11] obviously did not believe that all of the menstrual particles were dead and stated, "If bits of Mullerian mucosa carried by menstrual blood escaping into the peritoneal cavity are always dead, the implantation theory as presented by me is dead and should be buried and forgotten. If some of these bits of tissue are even occasionally alive, the implantation theory is alive."

Thus the discussion seemed deadlocked, awaiting proof as to the viability of castoff menstrual endometrium. Experiments on monkeys had been done earlier in an attempt to settle this point but on scrutiny they are impeachable for various reasons, but chiefly because transplantation of viable cells from the basilar layer of the endometrium could not be excluded. Our problem appeared to be the devising of a method whereby the endometrial particles normally cast off at menstruation might be deposited in the peritoneal cavity of the monkey. The rhesus monkey was chosen for the experiments since it is the only animal that has a menstrual cycle comparable to the human. In addition endometriosis practically never occurs spontaneously in monkeys. There is only one such recorded case occurring in a monkey in the London Zoo and proven at autopsy. Hence, we believed that if we should encounter endometriosis in our experimentation we could be certain that it had been artificially produced.

We first repeated the transplantation experiments of others by excising bits of endometrium after doing a hysterotomy and suturing them in various parts of the monkey's peritoneal cavity. In 6 of 7 monkeys so treated, the transplanted endometrium grew and produced a picture similar to human endometriosis. These experiments were purely confirmatory of work previously done and in no way answered the fundamental question of the possibility of growth of the castoff endometrial particles.

We then surgically treated monkeys so that they would pour forth the menstrual discharge directly into the peritoneal cavity. This was done by freeing the cervix from the vagina and rotating it so that it would discharge into the peritoneal cavity (fig. 1). The

vagina was closed as in a total abdominal hysterectomy. In other monkeys the cervix was cut across well below the level of the internal os, just at its attachment to the vagina. This modification was done in some instances because of technical difficulties in separating the cervix from the vagina (fig. 2). The animals were laparotomized

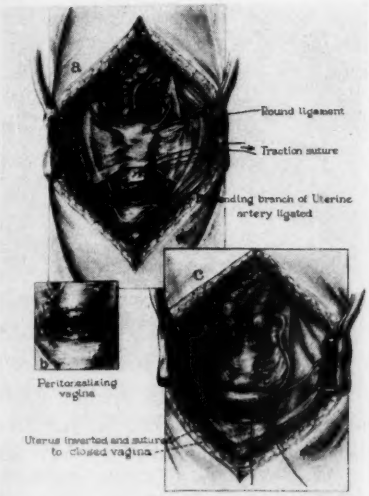


**Fig. 1. Cervix has been separated from vagina and rotated so as to permit menstrual blood to discharge into peritoneal cavity.**

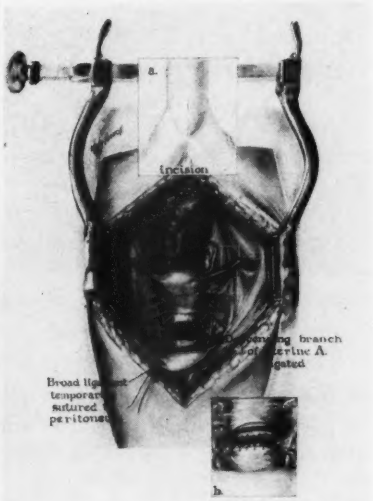


**Fig. 2. Low amputation of cervix from rest of uterus. Menstrual blood is permitted to enter peritoneal cavity.**

from time to time and inspected for visible evidence of endometriosis. The first evidence of endometriosis was found in one monkey on the seventy-fifth day but in another monkey it was not microscopically definitely evident until the nine hundred and sixty-third day. In 5 of 10 monkeys thus surgically altered endometriosis developed (figs. 3 and 4). The other 5 monkeys died before sufficient time had elapsed to determine the outcome of the experiment. These 5 monkeys died of complications, such as cervico-intestinal fistulas, hematocervix, hematometra, peritonitis and tuberculosis. Another monkey, in whom a cervico-abdominal fistula had been established, developed endometriosis after one year, in the scar tissue along the line of retraction (fig. 5).

These experiments are published elsewhere in detail and are available to those interested. Sufficient to say here that we believe the experiments indicate that castoff menstrual endometrial particles are capable of growth when deposited in the peritoneal cavity of the monkey.

Sampson's theory is further substantiated by the work of Fallon[13] who has made a composite picture of the sites of endometrial implants. Fallon has taken with him to the operating table a transparent plastic sheet upon which are outlined the pelvic viscera. Upon

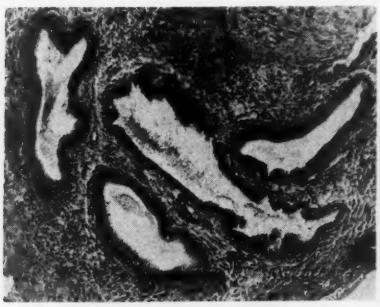

Fig. 3. Endometriosis growing in anterior cul-de-sac.

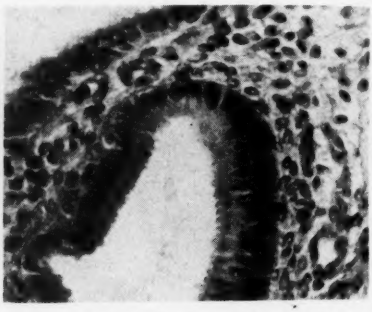

Fig. 4. High power picture of glands and stroma of same case as shown in fig. 3.

such a sheet he has placed a dot at each location of ectopic endometrium. By piling up great numbers of these sheets he has been able to produce a composite picture of the pelvic growths. The dis-

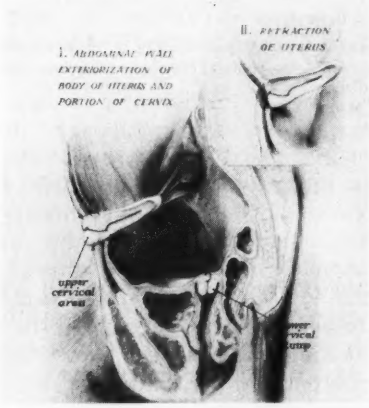


Fig. 5. Uteroabdominal fistula. Endometriosis developed in fistulous tract.

tribution is thickest posteriorly and in the dependent portion of the pelvis. This is as would be expected if the endometrial particles drop from the fimbria of the tubes which usually lie posterior to the uterus. To a lesser degree the anterior half of the pelvis is involved. These composite pictures confirm our clinical impression of the dis-

tribution of endometriosis and would seem to fortify Sampson's theory.

How shall we treat this interesting and common disease? We believe the essential treatment is surgical. The disease by its very nature is infiltrative and fibrophilic, thus being responsible for symptoms of a mechanical nature such as those caused by an adherent, retroposed uterus and relieved only by surgery. There is a flexibility of treatment possible with surgery which is not possible with irradiation. Early but conservative surgery usually permits the preservation of the childbearing function in the young. When the young married woman presents herself with a moderate amount of pelvic endometriosis she should be given the opportunity to become pregnant for a reasonable length of time but failing to do so, surgery is indicated while it may yet be done in a conservative manner to permit childbearing. If delayed too long, not only may sterilization become necessary but at times castration. The younger the patient and the more anxious she is to have children, the more one should put forth effort to do a conservative surgical job. In our series we were able to perform conservative surgery with the possibility of future childbearing in 58.3 per cent of our entire group of women in the third decade of life. But if we consider only the 243 women on whom surgery was done primarily for endometriosis, such conservative surgery was done in 74.4 per cent. Have these attempts at conservatism been worthwhile? Among the women in the third and fourth decade of life there were those who did not apparently desire more children for they practiced contraception. But of those who did not, 40.6 per cent conceived and 31.3 per cent bore live babies. However, of this same group 12.2 per cent required further radical treatment. Some of these were not subsequently operated upon in our clinic and we have no way of knowing whether all of the subsequent radical treatment was necessary. In this young group in whom we so frequently preserve the uterus we have in recent years performed presacral neurectomy and we believe our results would indicate that it is worthwhile.

In the fourth decade the flexibility of surgery also offers advantages. In this group there are still some women who desire more children and an effort should be made to permit them to do so. However, it is in this decade when hysterectomy with preservation of at least one ovary was most frequently practiced. Forty-six per cent of the women in this age group were so treated. That this is generally a satisfactory procedure is attested by the fact that only 4.1 per cent required further radical treatment. But in this age group the extent of the disease process often necessitates radical surgery and we performed it in 36.1 per cent of the cases. After

the age of 40 radical surgery may be done on lighter indications and was done in 60 per cent of our series. But, as can be judged from this figure, we do not believe that radical surgery is always indicated at this age. With hysterectomy and the preservation of one ovary, the patient can often be made quite comfortable and have several years before the onset of her normal menopause.

Finally, surgery is preferred because there is always the possibility in any condition in which there is ovarian enlargement that malignancy exists. The differentiation by pelvic examination between endometriosis and ovarian cancer is usually quite accurate but in those cases of endometriosis characterized by ovarian enlargement with little or no typical endometriosis change in the cul-de-sac, the possibility of ovarian cancer exists. We have reserved x-ray castration for those cases in which there has been symptomatic recurrences necessitating relief, especially in the older group of women. By observing this rule we have obviated the possibility of blindly irradiating carcinoma of the ovary.

There is insufficient evidence at present to permit anyone to be too dogmatic regarding the use of hormones in the treatment of endometriosis. We have reserved the use of hormones for those patients who have refused surgery. In such instances we have used stilbestrol rather than testosterone. We have seen a few women who have been treated by testosterone for endometriosis who have developed hirsutism. We have also had the experience of causing severe uterine hemorrhage by the use of stilbestrol. Hence our present inclinations are conservative in the use of hormones for this disease and have regarded their use as strictly palliative.

In summary there are three points that we would like to emphasize.

1. There is no typical history of endometriosis. The corollary to this would appear to be that laparotomy on the basis of history alone is not justifiable.

2. Conservative surgery on young women is indicated and pays dividends in future pregnancies.

3. Our experiments concerned with the creation of endometriosis in the monkey would indicate that castoff menstrual endometrium is capable of growth. This fact greatly strengthens Sampson's theory of retrograde menstruation.

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# THYROID CRISIS*

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IN 1934 Maes and his associates began a series of three reports on the results of the treatment of goiter in the New Orleans Charity Hospital that has covered the period from January, 1927 to July, 1939, and in 1939 Warren Sears and one of us made a study of 21 consecutive cases of spontaneous thyroid crises, all of which were fatal, occurring in the same hospital.

This report covers the general mortality of toxic thyroid disease in Charity Hospital for the years 1942 to 1949 inclusive but is especially concerned with thyroid crises.

You will be impressed immediately by the fact that our mortality, while it has improved, is still much too high. However, before you cast the first stone let me present some extenuating circumstances.

First, Charity Hospital is a large general hospital that draws patients from a large slum area and a large rural area, in both of which poverty and ignorance are the rule, medical care is often poor, and living conditions are worse. Consequently many of our patients arrive in foul condition. Other reported series[3,4] are in agreement with these figures, but are at marked variance with those reported from centers of thyroid surgery. Ravdin reports a .9 per cent mortality in 655 toxic cases with use of thiourea drugs, and mortality rates in the neighborhood of 1 per cent or less, in large numbers of cases, are reported by Lahey,[5] Cole,[6] and McArthur, Rawson, Means, and Cope.[7]

Second, in the years before 1940 our hospital was housed in old and dilapidated buildings that were poorly ventilated and frightfully overcrowded. Furthermore, during the years 1936 to 1938 our patients were crowded into temporary quarters while a new building was being constructed and were seriously disturbed by the noise and confusion incident to the construction of a steel skyscraper.

Third, prior to 1940 our resident surgeons were practically unsupervised because they were not under school control.

Fourth, Charity Hospital is a teaching institution and even now a large proportion of the cases operated upon represent the first

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such case handled by the operator. Competent supervision is now provided, but it is still true that each resident must do his first case and there are 8 to 10 new ones each year. Almost none of these patients is operated upon by a surgeon whose skill and experience equals that of the staff surgeons of the larger private clinics.

Fifth and last, but not least, the internists and general practitioners of a non-endemic area often know little about thyroid diseases and are inclined to use medical therapy far beyond its proper field of usefulness and safety.

Our reports cover all cases treated in the hospital whether by medical or surgical methods. While we realize that our results are not admirable we suspect that they approximate those of the country as a whole much more closely than do those of the great private clinics and should therefore serve as a form of shock therapy for the average doctor.

This report covers 484 cases of thyrotoxicosis observed during the years 1942 to 1949 inclusive. The general mortality was 23 out of 484 or 4.75 per cent. This is less than one-half the mortality in Maes's first series (10.8 per cent) and only slightly more than one-half of that in his entire series of 438 toxic cases (8.9 per cent). Let us call your attention to the fact that his second series showed a reduction of mortality from 10.8 per cent to 6.6 per cent whereas the third series showed a relapse to 8.6 per cent. We believe that he was correct in concluding that this was due to the overcrowding in temporary quarters and to the noise and confusion incident to the construction of the new hospital. This illustrates graphically the importance of comfortable, roomy, quiet, well-ventilated quarters in the treatment of thyrotoxicosis. We believe that the improvement shown since that date is in no small part due to the fact that we now have a hospital building that, from the standpoint of housing, is a model of its kind except that we cannot put our worst cases in soundproof, air-conditioned private rooms.

*Medical vs. Surgical Treatment*

Of our 484 cases, 337 were treated by surgical and 147 by medical methods. The mortality in the surgical group was 11 out of 337 or 3.26 per cent and that in the medical group 12 out of 147 or 8.17 per cent, or more than twice as high. While we admit that the medical list includes a few cases that it would be fairer to class as untreated it quite probably includes also some who died elsewhere, and the comparative mortality is, we believe, substantially true. These figures give strong support to our firm conviction that medical therapy, even with the thiourea drugs, cannot compete with surgery as a definitive method of treatment even when we leave out of consid-

eration the fact that most observers have found that 50 per cent or more of thiourea treated cases recur one to six months after treatment is stopped. We have had no experience with radioactive iodine.

TABLE I

| *Number* | *Type Gland* | *Type Treatment* | *Deaths* | *Mortality %* |
|---|---|---|---|---|
| 32 | Nodular | Medical | 3 | 9.4 |
| 135 | Nodular | Surgical | 6 | 4.45 |
| 115 | Diffuse | Medical | 9 | 7.84 |
| 202 | Diffuse | Surgical | 5 | 2.48 |
| 484 | | | 23 | 4.75 |

*Thyroid Crises*

We have been especially interested in thyroid crisis. In 1939, Rives and Sears reviewed 21 consecutive cases of non-surgical, more or less spontaneous, thyroid crisis. All were fatal and 16 of the 21 occurred in the hot months of the year. We were impressed by the fact that the complete failure of the heat regulating mechanism in these cases is strikingly similar to that seen in heat stroke. Since thyrotoxicosis causes increased heat production, and high temperature and humidity render heat elimination difficult, it seemed to us that summer in New Orleans (June to October), increased the hazard materially. McGregor supports this view as does Crile, who found crises 3.4 times as frequent in the summer months, but Foss and McArthur and his associates disagree. Our present series does not support our previous conclusion which we are still reluctant to abandon. Perhaps the discrepancy is due to the fact that these latter cases were treated in a roomy, well-ventilated modern hospital where marked temperature variations do not occur.

TABLE II

*Crises by Month*

| | | | | | |
|---|---|---|---|---|---|
| Jan. 4 | March 3 | May 4 | July 2 | Sept. 2 | Nov. 2 |
| Feb. 0 | April 2 | June 3 | Aug. 1 | Oct. 1 | Dec. 1 |

*Definition*

For the purpose of classification we have considered the characteristics of crisis to be fever above 103° F., a pulse rate in excess of 140 per minute, extreme restlessness, and augmentation of the usual picture of hyperthyroidism. These vital signs will be discussed in

detail later, and an attempt made to segregate true crisis from other reactions.

*Analysis of 25 Crises*

There were 25 crises of which 10 were fatal (40 per cent), a mortality rate which is in agreement with 30 cases from the literature analyzed by Fiske[10] (47 per cent), and Buxton[11] (50 per cent). Eight cases occurred in white females, 13 in colored females, 3 in colored males, and 1 in a white male. The ages varied from 15 to 69 years, the average age being 36.5 years.

*Medical vs. Surgical Crises*

Nineteen of the 25 crises were precipitated by operations and of these, 4 died (21 per cent). Six who developed crisis for no obvious reason all died. This brings our series of spontaneous crises to 27, with a mortality of 100 per cent and serves further to emphasize the danger of medical therapy. That the risk of medical therapy is largely due to its inadequacy which is often the fault of the patient does not alter that fact, because failure to follow instructions is a normal hazard of medical therapy carried on outside a hospital and it is impractical to hospitalize patients for months on end.

When thyrotoxicosis reaches such a degree that a storm develops without an obvious cause, treatment in our hands has been entirely ineffective. In these cases the source of the toxemia has not been removed and this fact may be an important factor. However, in one instance the crisis was precipitated by perforation of a peptic ulcer and this patient survived.

Twenty-three crises occurred in 317 toxic diffuse glands with 9 deaths, and 2 in 167 nodular glands with 1 death. Although in this series there was a great preponderance of crises in diffuse glands, there is no agreement among various reported series on the relationship between diffuse and nodular glands and crisis. McArthur, Rawson, Means and Cope[7] reported 20 of 36 crises as occurring in diffuse glands, and Boyce[1] reported 37 of 56 crises as occurring in diffuse glands. However, Buxton reports crises twice as often in nodular glands and Ransom found 22 adenomas in 37 crises. This may be due in part to the frequent lack of agreement between the surgeon and the pathologist on the classification of a gland. Frequently in this series nodules were reported by the clinical observer but not noted in the pathological description, and frequently glands considered diffuse by the surgeon were found to contain small nodules by the pathologist. In this series a gland was considered nodular if a nodule was found by either the surgeon or the pathologist. Boyd[13] does not consider the presence or absence of a nodule of any importance in the picture of hyperthyroidism.

*Effects of Thiourea Drugs*

The breakdown of cases by years (Table III) confirms the already-established fact that the incidence of storms is much lower now that the thiourea drugs are a standard part of the preparation. Sixteen of the 25 crises occurred during the years 1942 through 1944, when hyperthyroidism was treated by iodine alone. Sixteen cases had had iodine only, and of these, 4 died; 5 cases were prepared with both drugs, with 3 deaths, and 3 had no treatment, with 2 deaths (Table V). That propylthiouracil may not produce the expected results, even when properly used, is shown by case 20, which was given propylthiouracil one year and iodine 25 days before surgery; by case 22, which was treated with thiourea drugs seven months before surgery; and case 23, which was given propylthiouracil three months before surgery (Table V).

TABLE III

| | | | |
|---|---|---|---|
| 1942 - 5 | 1944 - 2 | 1946 - 2 | 1948 - 1 |
| 1943 - 9 | 1945 - 3 | 1947 - 2 | 1949 - 1 |

TABLE IV

| *Operation* | | *Death* |
|---|---|---|
| Closure Ulcer | 1 | 0 |
| Lobectomies | 5 | 1 |
| Subtotal | 13 | 3 |
| Not operated on | 6 | 6 |

*Associated or Complicating Diseases*

Associated diseases were present in 10 cases of crises. Cardiac disease accounted for 7 of these and all were considered as "thyroid hearts," all showing some degree of hypertension and decompensation, and 1 showing fibrillation. One presented a toxic psychosis as the outstanding symptom, 1 was associated with a perforated peptic ulcer, and 1 had just recovered from a fracture of the jaw when operated upon, with ensuing storm.

In 13 cases in whom liver tests were done, 11 showed no derangement of liver function, and 2 showed a positive cephalin flocculation. Both of these patients died.

*Metabolic Rates*

It is difficult to draw any conclusions from a study of the basal metabolic rates. All were elevated on admission (+ 29 to + 88) but the response to treatment and the criteria of the operators of readiness for surgery followed no consistent pattern. Nine cases

## TABLE V

| No. | Age | Color | Sex | Year | Type Goiter | Antithyroid drugs | Duration of treatment | Other diseases present | Original BMR | BMR at surgery | Av. pulse rate | Liver tests | Operation | Anesthetic | Result | Crisis temp. | Crisis pulse | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 48 | W | F | 42 | Nodular | None | | HCVD perforated ulcer | | | 170 | | Closure ulcer | Ether | Recovered | 106 | 170 | I.V. Iodine |
| 2 | 19 | W | F | 43 | Diffuse | Iodine | 4 days | | 29 | 10 | 120 | | 2 Lobectomies | Ether | Recovered | 104 | 150 | Crisis after each stage |
| 3 | 31 | C | F | 43 | Diffuse | Iodine | 7 days | | 71 | 58 | 90 | Neg | Lobectomy | Cyclo | Died | 106 | | Died that night |
| 4 | 58 | W | F | 42 | Diffuse | Iodine | 5 days | HCVD fibrillation | 85 | | 120 | Neg | None | None | Died | 104 | 160 | Psychosis |
| 5 | 21 | C | M | 42 | Diffuse | Iodine | 4 weeks | | 46 | 19 | 100 | | Subtotal | Ether | Recovered | 105 | 145 | Crisis then pneumonia |
| 6 | 25 | W | F | 42 | Diffuse | Iodine | 5 weeks | | 47 | 20 | 100 | Neg | Subtotal | Averton | Recovered | 105 | 160 | Tracheotomy with benefit |
| 7 | 33 | W | F | 42 | Diffuse | Iodine | 2 weeks | | None | | 90 | | Subtotal | Ether | Recovered | 104 | 150 | Almost died |
| 8 | 15 | W | F | 43 | Diffuse | Iodine | 2 weeks | | 43 | -11 | 105 | | Subtotal | Ether | Recovered | 106 | 170 | Tracheotomy with benefit |
| 9 | 48 | C | F | 43 | Diffuse | Iodine | 3 weeks | Cardiac | 46 | 37 | 100 | Neg | Subtotal | Ether | Recovered | 163.6 | 160 | Mild crisis |
| 10 | 57 | W | M | 43 | Diffuse | Iodine | 4 weeks | Psychosis | 84 | 48 | 100 | Neg | Lobectomies | Ether | Recovered | 107 | 140 | Crisis after each stage |
| 11 | 22 | C | F | 43 | Diffuse | Iodine | 16 days | | | 59 | 100 | Neg | Lobectomies | Ether | Recovered | 105 | 160 | Crisis after each stage |
| 12 | 42 | C | F | 43 | Diffuse | Iodine | 46 days | HCVD | 88 | 65 | 120 | Neg | None | | Died | 106 | 175 | Given X-ray, never controlled |
| 13 | 69 | W | F | 43 | Nodular | Iodine | 50 days | Cardiac | 75 | 59 | 110 | 4+ cephalin | Subtotal | Ether | Died | 103.6 | 145 | Heart failure |

TABLE V (*Continued*)

| No. | Age | Color | Sex | Year | Type Goiter | Antithyroid drugs | Duration of treatment | Other diseases present | Original BMR | BMR at surgery | Av. pulse rate | Liver tests | Operation | Anesthetic | Result | Crisis temp. | Crisis pulse | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | 18 | C | F | 44 | Diffuse | Iodine | 18 days | | 48 | 18 | 90 | Neg | Subtotal | Ether | Recovered | 103.4 | 170 | Crisis then pneumonia |
| 15 | 62 | C | M | 44 | Diffuse | None | 2 days | HCVD | 40 | | 100 | None | None | | Died | 107 | 176 | Thiouroid discontinued then crisis |
| 16 | 17 | C | F | 45 | Diffuse | Iodine | 13 days | None | | 24 | 110 | None | Subtotal | Ether | Recovered | 103.4 | 170 | Mild crisis |
| 17 | 29 | W | F | 45 | Diffuse | Iodine | 4 weeks | None | 60 | 15 | 110 | Neg | Subtotal | Ether | Recovered | 103.2 | 170 | Mild crisis |
| 18 | 28 | C | F | 45 | Diffuse | Iodine Thiouracil | 2 days | None | 77 | | 115 | None | None | | Died | 103.6 | 230 | No hosp. treatment 15 days, then crisis |
| 19 | 58 | C | M | 46 | Diffuse | None | 27 days | "thyroid heart" | 69 | | 105 | Neg | None | | Died | 102.8 | 178 | Apathetic thyroid |
| 20 | 34 | C | F | 46 | Diffuse | Propyl Iodine | 1 year 25 days | None | 77 | 20 | 90 | None | Subtotal | Ether | Recovered | 104 | 160 | Cord paralysis and parathyroid tetany |
| 21 | 27 | C | F | 47 | Diffuse | Propyl Proloid | 2 months | None | 73 | 23 | 110 | None | Subtotal | Ether | Recovered | 104.6 | 208 | No pre-op. iodine. BMR disregarded |
| 22 | 57 | C | F | 48 | Diffuse | Iodine Propyl | 7 months | HCVD | 67 | 17 | 70 | Neg | Subtotal | Local | Died | 106 | 130 | Cardiac |
| 23 | 36 | C | F | 47 | Diffuse | Propyl Iodine | 3 months 23 days | Fractured jaw | 62 | 39 | 95 | 3+ cephalin | Subtotal | Ether | Died | 104 | 140 | Never well controlled Very toxic |
| 24 | 33 | C | F | 43 | Diffuse | Iodine | 15 days | None | 78 | 60 | 110 | None | Lobectomies | Ether | Recovered | 106.8 | 160 | Crisis after each stage |
| 25 | 27 | C | F | 49 | Diffuse | Propyl | 1 month | None | 82 | 47 | 120 | None | None | None | Died | 104 | 188 | Admitted in crisis |

had a BMR above 20 at the time of surgery and 3 of these died of crises. Only 1 of these occurred in the period of thiourea therapy and that 1 died. Eight of these 9 crises and 2 of the 3 deaths would probably be preventable under present conditions. It should be noted that 1 patient who had a BMR of — 11 at the time of operation had a nonfatal crisis and that one of us (Rives) has had a similar experience at another hospital in a case whose BMR had dropped to 0 after thiourea preparation.

The preoperative pulse rate varied from 70-180, with most falling between 90-110.

The picture of storm followed an almost monotonous pattern, and has been adequately described by others.[7,14] Extreme restlessness leading to psychosis and then to coma, accompanied by a loss of the heat regulation powers of the body with high fever and pulse rate, in the presence of hyperthyroidism, are the diagnostic signs of crisis. In our cases, during crises, the pulse ranged from 140-208, averaging 160, and the temperature varied from 103.2-107° F.

Treatment is a straw in the wind of many of these storms. Iodine, $O_2$, heavy sedation, cold applications, propylthiouracil, digitalis, thiamine, fluids (often over 6,000 cc. daily), glucose, and adrenal cortical extract, were used. No conclusions as to the value of the various therapeutic measures used are warranted because there was no consistency in the plan of treatment on the various services and the number of cases is too small. It should be noted, however, that the postoperative cases fared far better than did those on medical services. This may have been due in part to the fact that the source of the toxin had been partially removed in the surgical cases but 5 surgical patients had only one lobe removed and 1 had the closure of a perforated duodenal ulcer. Only 1 of these died—not the ulcer case. It seems to us probable that on surgical wards crises was anticipated and that therefore treatment was more prompt and energetic.

We believe that failure of the heat regulating mechanism is the most significant feature of thyroid crisis and that therapy should be directed at control of this derangement. This can be done by reducing heat production and increasing heat elimination. Much of the increased heat is due to thyrotoxicosis over which we have no control after the crisis begins but it is seriously increased by the frantic muscular activity of the patient. Profound sedation is therefore essential. The air hunger caused by the increased oxygen need causes rapid forced respiration and the muscular effort required increases oxygen consumption and heat production. The administration of oxygen will, therefore, by reducing respiratory effort,

reduce heat production and oxygen need. Heat elimination takes place chiefly by conduction, convection, radiation and evaporation. The ideal condition for acceleration of the process is therefore to surround the patient with cold dry air so that there is a maximum temperature gradient between her body and her surroundings to promote conduction, convection and radiation, and a dry atmosphere to promote evaporation. An oxygen tent will meet all these conditions for the head, neck, and shoulders, but in a humid climate such as we have in New Orleans we must neglect evaporation and resort to the old-fashioned ice pack for the remainder of the body.

We have little confidence in the other therapeutic measures commonly used. Intravenous glucose will probably protect the glycogen reserves from the flame of the furiously-accelerated metabolism. Water is needed to replace the rapid loss from the skin and respiratory apparatus. We give iodine out of respect for tradition but without conviction as to its usefulness. We do not believe that iodine, thiouracil, thiamine, nor adrenal cortical hormones can be expected to have appreciable effects in less than 24 hours and the fate of most of these patients is determined before that much time has elapsed.

*Minor Crises*

The phrase "life endangering" is used in the definition of crisis by McArthur, Rawson, Means, and Cope to exclude the mild to moderate febrile reactions which often follow thyroidectomy for toxic glands. To our knowledge, these authors are the first to point out that these are "storms in miniature" since they differ only quantitatively from crises. We have arbitrarily defined these miniature storms as cases showing a reaction to surgery consisting of a temperature rise over 101° and less than 103°, with an increase in pulse rate not exceeding 140, and with mild restlessness. Less than this has been considered a physiological reaction to surgery, and more than this a true crisis. Care was taken, in so far as possible, to exclude atelectasis, bronchopneumonia, and other extraneous causes of these findings. There were 64 such postoperative "miniature storms" (19 per cent) with, of course, no fatalities. It should be borne in mind that these minor crises may quickly grow to major proportions if they are neglected.

*Mortality Factors*

In the time of onset after operation, and duration of crisis, our findings are in agreement with Ransom and Bayley,[15] and McArthur, Rawson, Means, and Cope.[7] All postoperative crises began within 12 hours of surgery. The duration of all cases was six hours to eight days, most lasting two to five days. Eight of the 10 deaths occurred within two days of onset of crisis; 1 death occurred in

three days, and 1 in five days. One might make a generalization here and say that if a patient survives the first 48 hours of the storm she will probably recover.

## Discussion

Inadequate preparation, or discontinuance of adequate therapy, was the cause of most of the deaths from crises. Eight of the 25 cases had obviously inadequate therapy, or premature discontinuance of therapy, and 6 of these died. The crisis which followed closure of a perforated peptic ulcer of course had no opportunity for preoperative therapy, but this case recovered. Another, whose crisis followed only four days of iodine therapy, also recovered. However, 4 deaths followed operation done after preparation with iodine alone for seven, five, four and two days respectively (Table V). One of these (case 18) was particularly unfortunate as this patient was kept in the hospital 15 days without therapy while a "base line of toxicity" was being established. Iodine was started two days before death from crisis in a belated attempt to avert the impending storm. Cases 15 and 25 also illustrate this point and are reported in detail. These 2 patients were being satisfactorily controlled on propylthiouracil when the drug was discontinued. When "escape" from therapy was complete they went into crisis and died.

The above points are cited to underline the real dangers of inadequate therapy and hasty operation. Another important point in this regard must also be emphasized: treatment with antithyroid drugs is not a cure and should be considered only as preoperative adjuvants. Hyperthyroid patients treated with thiourea derivatives as a substitute for surgical therapy are exposed to the risk of fatal crises after the drug is discontinued, as happened in 2 of our cases.

Another difficulty which was seen to recur again and again in review of the charts, was that of attempting to control toxic patients on an out-patient basis. Although this may perhaps be done satisfactorily with intelligent patients with adequate economic resources, it has proved dangerous in treating charity patients of low intelligence and economic status who are unable to rest in favorable environmental circumstances, and indeed are often unable to buy the medicine prescribed! Many cases listed as "medical treatment only" represent patients discharged on antithyroid drugs who never returned to clinic and have been lost to follow up. One can only speculate on their fate. Although the prolonged preparation of the hyperthyroid patient imposes a serious strain on already overburdened hospital resources, there seems to be no adequate substitute for hospital rest and treatment.

## Case Reports

The following unusual cases are reported to underline the difficulties which have been encountered in this area where the disease is "most a problem where it is least a problem" (Maes):

T. B. (Case 15), a 62 year old colored male, upon whom a diagnosis of hyperthyroidism was made April 13, 1944, on the basis of a diffusely enlarged gland, exophthalmos, and weight loss. The BMR was + 53 and the average pulse rate 100. Thiouracil, 600 mg. daily, was given from April 18 to May 24. The BMR's progressively fell to + 18, and the patient was gaining weight and responding well. He then received no treatment from May 24 to September 25, when he was admitted in violent storm and died in 40 hours.

V. G. (Case 20), a 34 year old colored female, upon whom the diagnosis of hyperthyroidism was made June 17, 1948, on the basis of weight loss, nervousness, diffusely enlarged gland, exophthalmos, and a BMR of + 77. She was placed on propylthiouracil, 100 mg. t.i.d., which she took as an out-patient until May 2, 1949. At this time she was readmitted and the propylthiouracil continued combined with Lugol's solution until surgery May 28. The BMR just before surgery was + 20 and the pulse rate 90. She went into a moderately severe crisis the night of surgery, but recovered. Cord paralysis and parathyroid tetany complicated the recovery.

Z. N. (Case 22), a very toxic goiter occurring in a 57 year old colored female. She had a diffusely enlarged gland, with exophthalmos, and symptoms of 4 years duration. She was given very closely supervised treatment for 7 months. During this period she received propylthiouracil (300 mg. daily) and thiouracil (600 mg. daily) alternately, combined with iodine prior to surgery. Her original BMR was + 64 and at surgery was + 17. She gained 13 pounds and her pulse was 68 before surgery. The blood pressure was 170/90. She had marked cardiac symptoms and was considered a thyrocardiac. In spite of the prolonged preparation in the hospital she died the night of surgery in crisis.

J. B. (Case 23), 36 year old colored female, had a three month history of hyperthyroidism with a BMR of + 54 when she was placed on 200 mg. of propylthiouracil daily June 12, 1947. This was decreased to 150 mg. daily June 18, and to 50 mg. daily July 2. It was increased to 100 mg. daily July 10. She gained 9 pounds during this period. An impacted tooth was drawn and the jaw fractured July 15, causing a temperature reaction to 102.6 and pulse rate to 120. Propylthiouracil was continued to operation (3 months) and Lugol's solution given 23 days before operation. The BMR September 9 was + 39. Operation was done Sept. 12, 1949. She died that night in crisis.

D. A. (Case 25), a 27 year old colored female, developed thyrotoxicosis (diffusely enlarged gland, exophtholmos, weight loss, nervousness) in April, 1949. The BMR July 13 was + 82. She was placed on propylthiouracil, 300 mg. daily, from July 15 to August 20, at which time she was gaining weight and the BMR was + 47. At that time she stopped taking the drug and when next seen on Sept. 9, 1949, she was losing weight, was obviously very toxic, and the pulse rate was 132. She was immediately admitted to the hospital but went into crisis that night and died 5 days later. In spite of all therapy her heart literally beat itself out.

## Summary and Conclusions

1. A study was made of 25 crises occurring in 484 hyperthyroid patients.

2. A reduction in the over-all mortality rate in hyperthyroidism in this hospital has been noted from 9 per cent in previous series to 4.75 per cent in the present series. Since most of the deaths were considered preventable, further reductions in the mortality rate must be accomplished.

3. The mortality rate in thyroid crisis was found to be 40 per cent. There was no significant seasonal variation. As expected, fewer crises were encountered as the thiourea drugs became part of the routine management.

4. Nineteen crises followed surgical procedures, with 4 deaths. Six crises had no obvious precipitating factor and all 6 died.

5. A definition is offered for the cases described as "crises in miniature" in which all the elements of crises are present but which are not life endangering. It is conceded that this diagnosis must usually be made in retrospect.

6. If a patient is to die in crisis, death usually occurs within 48 hours of onset.

7. Two patients are described who were controlled on propylthiouracil and then went into fatal storm after the drug was discontinued. Three cases are described who went into crisis after surgery in spite of prolonged therapy with thiourea drugs (1 year, 7 months, 3 months).

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# THE CROSS FINGER FLAP: A NEW METHOD OF REPAIR

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THE cross finger flap is analogous to the cross leg flap which has proved so useful as a method of replacing certain losses of skin and subcutaneous tissue of the lower extremity. The writer first used this method as an original procedure in February, 1945, while serving as chief of an Army Plastic and Maxillo-facial Center in England. Later he presented the cross finger flap as part of a scientific exhibit in November, 1949.** Since then, Gurdin and Pangman[1] have reported briefly on the use of this method. Barsky[2] used a damaged finger, which was going to require amputation anyway, as a cross finger flap to repair another digit. However, no mention was made of the cross finger flap as envisioned in this paper, i.e., a source of tissue not requiring sacrifice of or damage to the donor finger. No other reports have been found in the literature.

In the past, any wound or deformity of the finger, however small, which has required both skin and subcutaneous tissue in its repair, has generally meant the attachment of the finger to some distant source such as the abdomen, chest or opposite arm. Such positions are obviously uncomfortable and inconvenient to the patient, and if they can be avoided will reduce discomfort, hospitalization and expense. Furthermore, the skin from such sources is thick and there is an excess of fat, which despite efforts to thin it out, usually results in a rather bulky flap, lacking in stereognostic sense. While flaps from distant sources will always be necessary in the repair of extensive defects, the method to be described will obviate their use in most small and medium sized defects.

## INDICATIONS

The cross finger flap is indicated in the repair of all wounds or deformities requiring the use of both skin and subcutaneous tissue, whether on the flexor or extensor surfaces and limited only by the available amount of skin on the adjacent finger. Thus the largest flap that could be raised would, in length, measure one half or perhaps a little more of the circumference of the finger, while, in width,

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it could extend from a point slightly proximal to the web to a short distance proximal to the nail. The chief indication for this method is in the coverage of structures not suitable for repair with free skin grafts. Such structures are: tendons (figs. 1, 8), bones, joints (fig. 2) and sometimes nerves. In addition, deep losses of the pulp (fig.

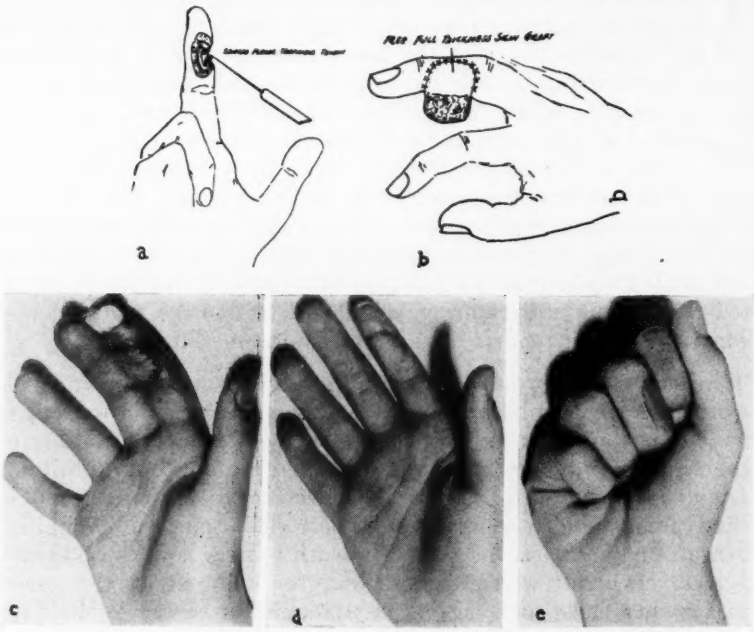


Fig. 1. Yancy. a. Wound showing severed flexor profundus. b. Cross finger flap ready to be attached to index finger. c. Showing flap in place on the 19th post-operative day. d, e. Appearance and functional result 11 weeks later. Note size of donor site in e.

3) and amputation stumps are ideal for repair by this method. The cross finger flap furnishes a well padded covering over the end of the bone and preserves all possible length (fig. 4). The free full thickness skin graft so often advised for stump coverage to preserve length of the finger, though used successfully by the writer and favorably reported in the literature[3,4,5] may sometimes be unsatisfactory due to lack of padding and adherence of the graft to the bone. The cross finger flap is used to cover the stump at any level of amputation *unlike* the thenar or hypothenar flaps,[6,7] which are suitable only for tip amputations because of the distance involved. Flaps from this region also produce scarring on a useful surface of the hand.

## Technic

The technic is well depicted in the accompanying drawings which show various situations in which the cross finger flap may be used. A proper fit is assured by trial with a cloth pattern before the flap is actually raised. With due care in the dissection and the use of a tourniquet on the arm, there should be little danger of injuring the digital nerves or vessels. None have been injured in this series. For immobilization, a light plaster splint may be used. In the stump cases, where the fingers are flexed, gauze is packed around the fingers to form a fairly voluminous bandage and the whole hand is then wrapped with an ace bandage.

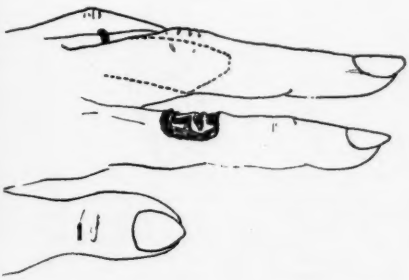

Fig. 2. A safer method of covering dorsal defects than in fig. 5. The possibility of flexion contractures and nerve injuries are avoided.

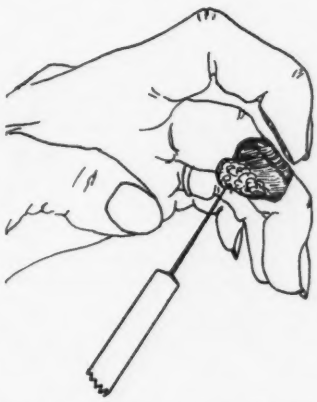

Fig. 3. To repair a loss of the pulp the fingers must be flexed as shown.

A split skin graft is generally used to cover the site from which the flap is elevated. Where a flap is used to repair an extensor surface defect, it may be necessary to encroach on the flexor surface to secure a flap of sufficient length, in which case it is best to use, in a child, a free full thickness skin graft and in an adult, a very thick split graft to replace the flap, in order to avoid subsequent contracture (fig. 5).

The pedicle of the flap is cut after an interval of two to three weeks and usually the cut edge of the flap is left to heal with few or no sutures and with little or no undermining or revision of the edge, because of the danger of injuring the newly acquired blood supply to the flap. The cut edge of the flap heals promptly and with surprisingly little scar.

The flaps are usually raised and transferred without delay, but

in cases where a very large flap is required, a preliminary delay is carried out a week or so before the transfer to insure an adequate blood supply (fig. 6). If an exposed tendon is to be covered, it is best to excise a little additional skin at each end of the wound so that the scar will not directly overlie the tendon. Successful primary tendon repair has been accomplished with cross finger flap coverage (fig. 1). Secondary tendon or grafting is believed to be feasible also, though as yet none have been done.

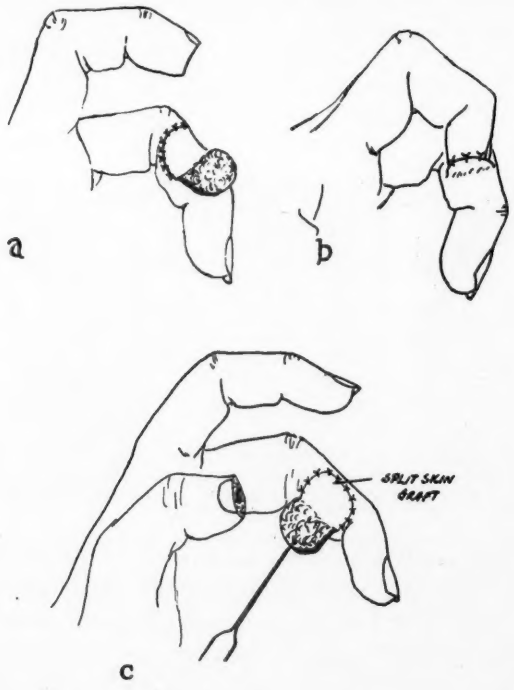


Fig. 4. Method of covering amputation stumps. a, b. Finger. Note how fingers are flexed to secure a comfortable attachment. c. Thumb. Repair with flap from middle finger.

Cross finger flaps have been used on 7 patients. In no case has any of the flap been lost from lack of a blood supply or from any other cause, nor has there been any damage to digital nerves. In 5 cases the indication was tendon coverage and in 2 it was repair of an amputation stump. In all cases the result has been better than that to be expected from the use of distant flaps.

### Typical Case Reports

On April 10, 1947, W. Y., a 7 year old boy, fell on a piece of glass severing the profundus tendon and shaving off the overlying skin and subcutaneous tissue of the right index finger (fig. 1). The tendon was repaired with stainless steel wire and the wound covered with a cross finger flap. A free full thickness skin graft was used on the donor site.

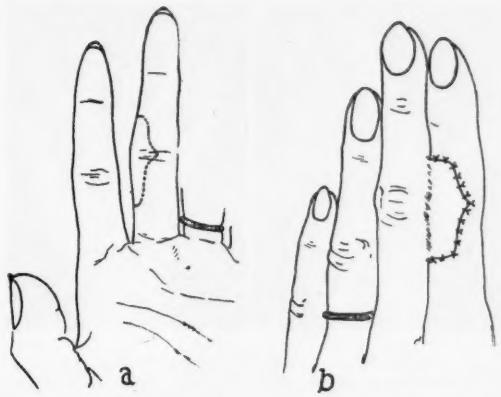


**Fig. 5. Repair of dorsal defects (b) by the above method should be undertaken with great caution to avoid flexion contractures and injury to the digital nerves. If a flexion crease must be crossed, a triangular excision is made at the crease to avoid a straight line which would contract later. a. Furthermore, a *thick* graft is essential to avoid subsequent contractures; a free full thickness in children and a very thick split in adults.**

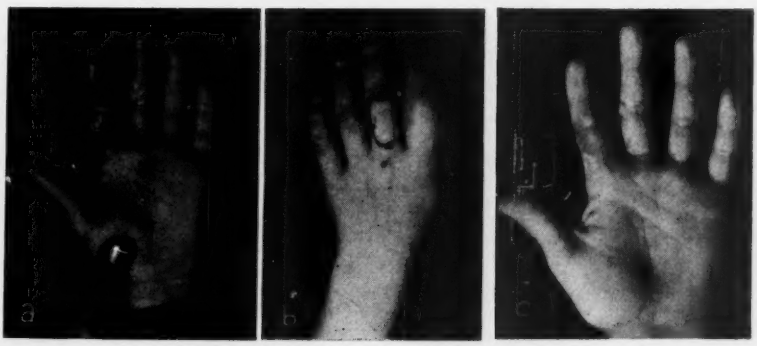

**Fig. 6. a. Electric burn on second day. b. This flap was partially elevated and delayed because of its size. c. Appearance six months later.**

On May 5, 1947, the pedicle was cut and the edges sutured, after proper trimming. Final result: Complete range of motion of tendon and joint.

On Jan. 1, 1950, J. T., a 7 year old boy, picked up a live wire, receiving a deep electrical burn of the flexor surface of the left index finger (fig. 6). On

January 3, when first seen, the tissues were hard and white from the proximal crease to the middle crease, involving half the circumference of the left index finger. Active flexion and extension was possible. Sensation at tip was normal. On January 5 a large cross finger flap was elevated and delayed. On January 16, necrotic tissue, including part of the profundus tendon was debrided and the wound covered with a flap from the middle finger. On January 23, partial

**Fig. 7. a. Flap attached to an amputation stump. b. Appearance four months later, showing healed stump with relatively little shortening; the nail growing out and the donor site.**

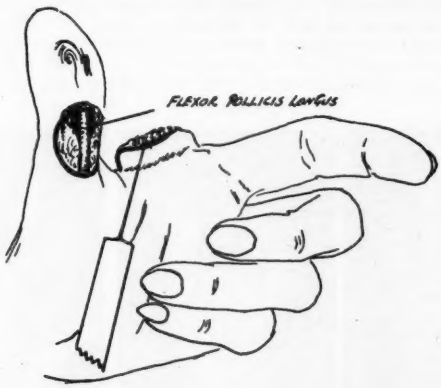


**Fig. 8. Flap from radial border of hand to cover defect of thumb.**

separation of flap occurred due to further necrosis of the burned area. On January 30, removal of the necrotic tissue was finally completed. The still healthy flap was pulled over the wound with adhesive tape. On March 1, the fingers were cut apart.

On Aug. 21, 1950, final result: Moderate flexor sublimus action is present though middle interphalangeal joint cannot be extended completely. Sensation in tip of finger is slightly impaired. Further surgery refused.

*Comment:* The extent of destruction was deceptive, as with all electrical burns. In an effort to save the exposed flexor tendons, the flap was applied too soon. Despite this, good coverage and a fair functional result was obtained.

On Aug. 8, 1949, J. F., a 28 year old worker, mashed end of left middle finger between a drill stem and a wrench. On August 17, when first seen, an irregular amputation near base of finger nail was noted. Gangrenous tissue and splintered bone were still present. The gangrenous tissue and loose bone was removed from day to day as separation occurred. On September 2, the stump was repaired with a cross finger flap (fig. 7). On September 16, the fingers were cut apart, leaving the cut edges to heal in.

On Jan. 1, 1950, final result: Excellent. The tip was rounded and not sensitive and the nail had grown back fairly well.

*Comment:* This case illustrates the value of the cross finger flap in finger tip amputations. In the usual clean amputation, the flap could be used immediately. Note that transfer of flap was completed in two weeks.

## SUMMARY

1. An original method of utilizing flaps from one digit for the repair of another is described.

2. The cross finger flap is indicated for the coverage of exposed tendons, bones, joints, loss of pulp and amputation stumps.

3. Seven cases (3 reported in detail) have been successfully repaired with cross finger flaps.

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# COLOSTOMY AND ILEOSTOMY

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WHENEVER one is called upon to do a colostomy or ileostomy as an elective or emergency procedure it is imperative that he know the various types of operations, their technic and postoperative care. We believe that the surgical profession is to blame for most of the poor results in colostomies and the purpose of this paper is to present some of the more important practical points of this operation.

The surgeon has an implied contract to teach the patient how to manage his colostomy and how to do it with a minimum of inconvenience. No one wants a colostomy and it is entirely a substitute procedure. Often the substitution is for the privilege to live. With more time spent on the psychology of the colostomy, we can easily turn the axiom around and say "I would rather have a colostomy than die."

Colostomies in general have a bad reputation and a good part of this reaction comes from the fact that palliative loop colostomies used in inoperable carcinomas are never very satisfactory because the patient still has the carcinoma and a great many of the symptoms are due to the malignant lesion.

Planned colostomies with the proper psychological and technical postoperative care are entirely livable and thousands of people today are leading normal lives with such operations. Even in palliative colostomies Bacon[12] thinks that life with a carcinoma is extended from six to eight months and one could never compare this value to its inconvenience. Such a procedure permits further cleansing of the bowel, relief of diarrhea or bowel discharge and reduction in toxicity.

The purpose of any colostomy is to divert the fecal stream. Whatever the indication, never delay until obstruction is complete. Plan the colostomy, locate it properly, control the odor, time and the consistency of the bowel movements, and the result is a satisfied patient.

## TYPES OF COLOSTOMY

Colostomies may be either temporary or permanent, single or double and can be made in almost any part of the colon. If there

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is a choice, the best location to make a colostomy is probably through the sigmoid colon, and the second choice would be the transverse colon.

The single or end colostomy is usually a permanent one and is most often made in the sigmoid colon as a part of an abdomino-perineal resection for carcinoma of the lower rectum. The double barrel colostomy is best exemplified by one known as the loop colostomy, or merely the exteriorization of a loop of colon.

The Mikulicz technic in a double-barreled colostomy is one whereby the two limbs of bowel are sutured together intraperitoneally and the loop of bowel that is exteriorized is divided between clamps. The approximated intraperitoneal bowel forms a spur and this can be later crushed and necrotized, thereby re-establishing the fecal stream down the bowel.

The Devine colostomy is a double-barreled colostomy usually made in the transverse colon and it is similar to the Mikulicz in that the two loops of bowel are approximated intraperitoneally with sutures; however, the ends of the bowel are divided at the fascia level and brought out through incisions lateral to the original incision. The approximated bowel or spur is crushed with a special clamp which enters each limb of the divided ends. After the spur has been crushed, and continuity re-established, the cutaneous stomata are cauterized. As a result of this they will close without further care. These variations in technical procedures are usually the results of an individual preference. Each method has several advantages as will be pointed out later. The Mikulicz operation is especially applicable to patients with diverticula, fatty epiploic appendages or extremely fat mesenteries where an end-to-end anastomosis is difficult. The same would apply to the Devine type.

## Technic

In the preoperative preparation it is essential that the bowel be as empty as possible. This can be done with laxatives, purgatives or enemata. We often give small doses of saline laxatives two or three mornings before operation.

Dependent upon many conditions, the bowel is usually prepared with chemo-therapeutic drugs using the invaluable information given to us by Poth[26]. We believe that it is essential that the colostomy be brought out of the abdominal wall through muscle and not through fascia; however, we do not believe that there is any sphincter action as a result of this muscle encirclement. One should place a colostomy away from any bony prominence especially the anterior superior spines and finally, it should not be near the umbili-

cus. In spite of the fact that we do not advocate the use of any type of bag postoperatively, every colostomy patient has to wear a bag at some time and it is difficult to cover the umbilicus and keep it clean. In the male especially one should be aware of the belt line in making a colostomy and either put the stoma above or below the belt. Most belts are carried well above the umbilicus.

In making a colostomy we prefer the technic as described and taught by Cattell. The type of colostomy is entirely dependent upon the indications for the operation and the condition of the patient. For decompression a transverse or sigmoid loop colostomy is usually done and if possible the Mikulicz modification is added. We will describe the sigmoid operation.

The abdomen is opened through a left rectus incision splitting the muscles between its middle and outer thirds and making about one half of the incision above the umbilicus. The deep epigastric artery is usually preserved. The left lateral peritoneal reflexion on the sigmoid is freed, leaving a small edge of peritoneum on the bowel for later closing the left lateral gutter. The sigmoid and descending colon can be completely explored through this incision and if necessary the splenic flexure released. This cannot be done through a McBurney incision. The vessels in the mesentery are completely visualized and the mesentery is opened under direct vision, being sure to leave the marginal vessels. After the sigmoid has been mobilized sufficiently, the redundant loop is brought up through the incision.

If the Mikulicz technic is to be used, the bowel is sutured together along the longitudinal bands for approximately four to six inches intraperitoneally. If possible two parallel rows of such sutures are taken in order to further widen the spur. This technic makes for an easy extraperitoneal closure, however, with modern chemotherapy we fully realize that the ordinary loop colostomy can be closed with impunity by end-to-end intraperitoneal anastomosis. The loop of bowel is brought through the incision and the abdominal wall closed. In this closure the appendices epiploicae are tied into the peritoneum and fascia on each side of the bowel and the closure is in a funnel shape with the peritoneum being the tightest. There must be enough space around the bowel to easily insert a finger. No sutures are placed in the bowel wall itself. The left lateral gutter is closed before the peritoneal cavity is closed and this is considered a most important step. At the present time our method of closing the abdominal wall is to use medium-sized chromic catgut for the peritoneum and rectus muscles and interrupted wire sutures in the fascia. No stay sutures are used. After the skin has been closed,

it is painted with compound tincture of benzoin and the wound dressed dry.

The colostomy is therefore held in place by first the gutter suture, then the appendices epiploicae, the abdominal wall, dry gauze and with a loop colostomy, the glass rod. If possible we divide every colostomy between two large Ochsner clamps at the time of its making. When this is done, the clamps further hold the colostomy in place. If the bowel is divided, it is important to make the division such that the proximal end extends at least one and one-half inches above the skin whereas the distal end can extend only one-half inch above the skin. The proximal end will retract to some degree, the distal end will not. It is wise to consider whether the patient will gain weight postoperatively. If the abdominal wall increases in depth the colostomy will retract even more. Be sure to have enough bowel above the skin level or routinely "umbilicate" the stoma by suturing the subcutis to the fascia.

If a loop colostomy is decided upon, the usual technic is to open the exposed piece of bowel in 12 to 36 hours. This can be done on the antimesenteric side with the actual cautery and without pain. If the wound has had 24 to 48 hours grace before the bowel is opened, it is not necessary to insert a catheter into the opening.

If the obstructed method of colostomy is used, the proximal limb can be opened after 24 hours by simply sliding the Ochsner clamp off a small segment of the bowel and inserting a rectal tube below the peritoneal level. This tube will stay in place from three to five days and it will not be necessary to dress the colostomy wound until that time. After about five days, the clamp will either come off or it can be removed. The distal clamp will likewise come off in about five to seven days.

In a sigmoid colostomy it is essential that the proximal limb be brought out of the abdominal wall directly without a reservoir of bowel within the abdomen. This will prevent prolapse of the stoma. It is equally as important that the tension not be too great on this limb.

In a left sided colostomy there is no necessity for the use of a paste on the abdominal wall. We usually give a small dose of milk of magnesia orally on about the fifth day and begin the irrigations on about the seventh day.

There are many ways to make and care for colostomies. Heyd[10] advises the use of a Devine colostomy and he sees this to be much more efficient and safe both as a temporary or permanent operation. He uses an upper right rectus incision and sutures the inferior longitudinal bands of the ascending and descending limbs of the trans-

verse colon together for about 12 cm. and up to about two inches of the division of the bowel. The bowel is brought out through the original incision up through the fascia; then a parallel stab wound is made on each side of the skin about 3 cm. away. The ends of the bowel are divided and brought out through the stab wounds. The peritoneum is then closed around the two limbs and there are no sutures taken in the bowel. At the appropriate time the spur is crushed with the special clamp and the mucosa of the stomata cauterized to hasten spontaneous closure. The content of the transverse colon is more liquid than that of the left colon and therefore a transverse colostomy is often harder to handle from that respect. Certainly, the Devine colostomy completely diverts the fecal stream.

Fallis[6] prefers a transverse colostomy also. He uses a 4 in. transverse incision over the right rectus muscle midway. between the xyphoid and the umbilicus. The rectus muscle is cut across and the peritoneal cavity is opened transversely. The loop of bowel is brought through the incision and held in place over a glass rod. He places a single non-absorbable suture in the linea alba and one on the medial rectal sheath. A few hours later the dome of the bowel is aspirated with a 20 gauge needle, and in 12 hours the antimesenteric border is opened transversely. Irrigations are done in a few days and the mesenteric border is opened in two weeks for complete division and diversion of the stream. His method of closure of this colostomy is intraperitoneally by an end-to-end technic.

Brunschwig[3] in writing about the radical excision of pelvic viscera for carcinoma advocates bringing the colostomy out through the midline.

Rank and Smith[5] have a rather elaborate operation for colostomy in that they make a skin tube for the bowel and occlude the stoma with a mechanical plug. Hirschman[3,4] puts his colostomy stoma at or as near the umbilicus as possible.

When a cutaneous stoma is not desired, Berman[8] opens the bowel, inserts a Miller-Abbott tube, and closes the bowel around the tube. He thinks that the bowel can be irrigated and decompressed by this method and no secondary operation is necessary. This method is believed to be ideally used in the cecal area when there is an obstruction in the transverse or left colon. After the definitive operation has been completed, the Miller- Abbott tube is withdrawn. Windham[15] uses a similar technic in that he advocates a Miller-Abbott tube through the distal limb of a transverse Devine colostomy. Millet[9] puts a cecostomy tube in the cecum and inserts a Miller-Abbott tube through the cecostomy tube. He says that the Mil-

ler-Abbott will go to the sigmoid colon and relieve any obstruction. Progress of the tube is checked by x-ray and Millet says the bowel can be decompressed and irrigated through the tube.

Breidenbach[2] advocates the use of a defunctioning colostomy in the left upper quadrant through an 8 cm. transverse incision in the rectus muscle. Each loop comes out through the end of the incision and the colostomy is therefore a divided one. The closure is by an end-to-end intraperitoneal method.

Keene[22] does not believe that a loop or double barrel colostomy will defunctionalize the distal bowel for there is always some spillage. He advocates a divided stoma about 5 to 6 cm. apart.

Bacon[12] uses a left lower quadrant McBurney incision about one and three-fourths inches from the anterior superior spine. He uses a loop colostomy and opens the loop in two to five days. During this time he avoids any type of residue diet.

Jones at the Crile Clinic approximated the appendices epiploicae instead of the bowel walls in a Mikulicz type operation.

## Closure of Colostomy

The indication for a colostomy often dictates the time and method of its closure. In a Mikulicz type as soon as the colostomy functions well, the skin incision has healed and the mucosal edema has subsided, the spur is crushed with an Ochsner clamp. We have tried using several of the special spur crushing clamps, however, these have not been as successful in our hands as a standard hospital clamp. If, when applying any type of enterotome, there is evidence of tearing or perforation of the bowel or the clamping of some bowel other than the spur, the crusher should certainly be removed at once. After the spur has been sufficiently crushed and the fecal stream is going over the spur, then one can consider closure.

Dr. Lahey[20] advocates waiting for at least two months before closing his Mikulicz operation. Shallow's average waiting period is three months. He allows a minimum of 10 days after the formation of the colostomy before crushing the spur and at least 10 days after it is crushed.

In the closure of any colostomy, the preoperative preparation is most important. Each surgeon seems to have his own regime for getting the bowel as clean and empty as possible. This can be done with low residue diet, enemas and laxatives. For about five days before operation we routinely use some form of intestinal chemotherapeutic drug and have recently given Phthalylsulphacetimide (Thalamyd-Schering). The dose is the same as that for sulphasuxidine.

An elliptical incision is made around the colostomy leaving a small cuff of skin on the mucosa for traction, and the bowel is freed down to the peritoneal level. If the peritoneum is opened, care is taken that no more intraperitoneal adhesions are severed than necessary. After the bowel has been completely freed from the fascia and muscle, the skin cuff is excised and the bowel is closed transversely with a Connell suture of catgut and a second row of interrupted sutures of cotton or silk.

In the separation of the bowel from the subcutaneous tissues and fascia, it is occasionally necessary to insert the finger in the bowel to increase the attenuation of the serosa and aid in the dissection. An adequate blood supply is, of course, essential and a very accurate approximation of the mucosa and serosal surfaces without tension is imperative. As in any anastomosis, an adequate lumen is necessary even though further stricturing of the colon after anastomosis is uncommon.

The muscle is closed with fine catgut over the bowel, and wire sutures are used in the fascia. A small Penrose drain is placed beneath the muscle closure and brought out of the lower angle of the skin wound.

Postoperatively, the patient is given the necessary intravenous fluids until peristalsis starts and then begun on liquids and solids. Depending on each case some type of chemotherapy is usually used. If contamination is inadvertently more than desired sodium sulfadiazene is used intravenously.

Shallow[7] advises leaving a one-fourth inch ring of fascia attached to the serosa and after the bowel has been approximated, the fascia is sutured as an extra layer of closure. He thinks it takes the tension off the bowel closure itself.

Coller and Vaughan[19] don't use a spur crusher. They free the bowel completely, anastomose it by end-to-end suture and use a late closure method for the wound. Hertz and Poer[31] close the colostomy as usual and then open the peritoneum and drop it back. Pilcher[1] feels that the Mikulicz operation for traumatic wounds does not close nearly as satisfactorily as an intraperitoneal closure. He frees the bowel and does an end-to-end anastomosis and believes this to be more accurate, more anatomical and giving a shorter convalescence.

Sanders et al[27] have used and advocated the Pauchet technic in closing a colostomy. This is a type of closure involving the principle of the Finney pyloroplasty. The two bowel limbs are sutured together as usual in making the colostomy and at the time of closure each limb is opened from the stoma downward near the original

suture line. The closure is begun at the stoma side of the incision and carried out in the same manner as a pyloroplasty by suturing the mucosa downward as far as the incision is made and returning upwards making the first anterior layer. This closure gives a large lumen even with three layers of sutures and is done intraperitoneally. There is no chance of a hernia, no spur crushing and it is a time saver. This method is somewhat similar to that used by many surgeons where the stoma is further opened longitudinally on each limb of the bowel and then closed transversely (fig. 1).

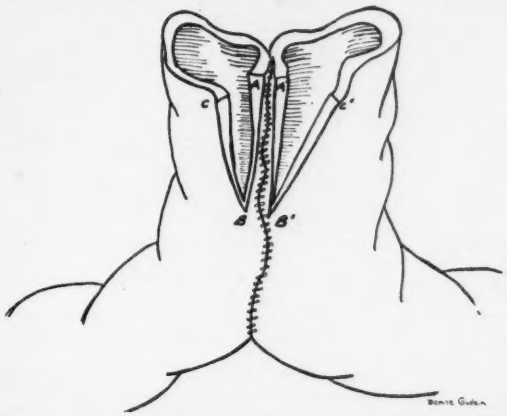


**Fig. 1. Pauchet technic for closure of colostomy as advocated by Sanders, et al[27] and based on the principle of the Finney Pyloroplasty. The presutured bowel is incised from the stoma downward 5 cm. and the closure begun by suturing from the stoma (A to A') downward to the bottom of the incision (B to B') and back upward (C to C'). This gives a large ampulla even with two rows of sutures.**

## Patient Care

It is our belief that a well placed and well made colostomy can be well tolerated by the patient provided the doctor spends enough time instructing the patient as to its management. As mentioned before, it is impossible to completely control a palliative colostomy for inoperable carcinoma. With a planned colostomy a patient needs from four to six months of constant attention to make this nuisance perfectly compatible with a normal life.

We believe that the colostomy drainage should be controlled with diet and periodic irrigations. We teach the colostomy to move only when the patient desires it to move. After the routine has been established about 75 per cent of these patients do not wear a bag of any type and their irrigations are done every 48 hours. Immediately postoperatively, we advise the use of an elastic girdle and by

perforating this girdle and inserting a flat rubber bag* over the colostomy stoma the patient immediately feels that his affliction has been partially improved (figs. 2, 3).

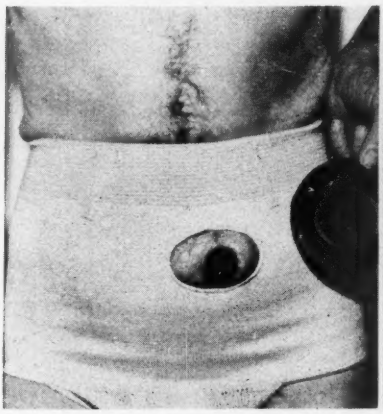

Fig. 2. Showing the girdle used immediately postoperatively to cover the colostomy until the irrigations are perfectly tolerated. The perforation over the stoma fits into a grooved flat rubber pouch (R. Gricks Manfacturer, 202 Jamaica Avenue, Hollis 7, N. Y.).

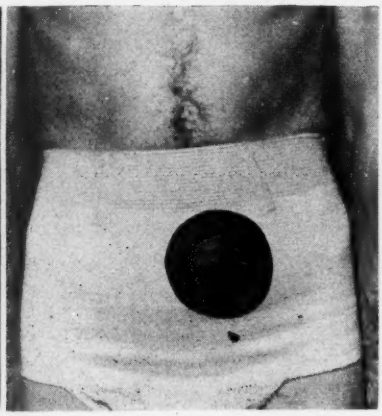

Fig. 3. Showing the Gricks pouch in place. The covering of the stoma and the use of a deodorizing capsule are especially appreciated soon after operation.

At this time we give all of our patients a deodorizing capsule under the trade name Carbisol.** These capsules can be gotten as plain (for ileostomy) or Enteric Coated (for colostomy) and are most satisfactory. The odor from the colostomy is practically nil. We have found, however, that some patients with a left-sided colostomy have to take the plain tablets for the Enteric Coated ones are delivered at the stoma intact.

If you can cover the colostomy temporarily and remove the odor you can immediately see the change in the patient from a disbeliever to one that actually thinks he can live with an abdominal anus. In general we begin colostomy patients on a constipating diet and avoid fresh fruit, vegetables and other odoriferous foods. The common constipating foods are boiled milk, dry cake, boiled eggs and creamed soups and vegetables. It is amazing how each individual patient will soon find that he can tolerate certain foods that others

*R. Gricks Manufacturer, 202 Jamaica Ave., Hollis 7, N. Y.

**Carbisol-Rego Products, Anoka, Minn.

cannot. We urge them to try most foods in order to establish their own individual diet. Each patient is given paregoric for use in emergencies.

Irrigations are done about the seventh day postoperatively and these are done every day for about two weeks. We use 250 to 500 cc. of warm water and the bowel is irrigated with the patient lying on the side (left usually). A lubricated catheter or small rectal tube is inserted into the proximal stoma for 6 in. or more and the water pressure gradually increased. At first patients will immediately have a sense of fullness and some tendency to nausea; however, this soon subsides on further irrigation. A convenient method to catch the enema is to use a male urinal. This is placed against the stoma and held there firmly to prevent spillage. Our patients are begun on this method and as they become more accustomed to the irrigations and can take more water, we then put them on a 48 hour schedule.

Most patients elect to do this irrigation at night and since every patient with a colostomy becomes an inventor, each will design his own means and technic of procedure.

As soon as the patient realizes that he does not need a bag of any kind most of them will then use a normal elastic girdle. Lahey has taught a method of loosening the elastic in the girdle over the colostomy and making a brassiere type of effect. Cotton, gauze or Kleenex are put over the stoma and under the girdle. He feels that it is a failure if the patient wears any type of bag. It takes months for patients to become accustomed to their colostomy and it is our bounden duty to help as much as possible. We must teach them to care for their colostomy as one would teach a child to read. This cannot be done in one day.

As you well know, there are literally hundreds of various gadgets for use on colostomy patients and many surgeons have found some of them satisfactory. Dr. Lamson has a balloon which he inserts in the colostomy and on inflating the balloon the colostomy stoma is closed. There are a great many outfits to apply over the stomata for use with rubber and single use disposable bags. These have to be individually made for each patient. There are also many types of aprons and tubes to be used during the irrigations and we give each patient an opportunity to see the different advertisements. Most of our patients, however, seem to use the simplest method and that is sitting on a small stool in front of the toilet bowl and guiding the enema excreta to the bowl with some simple device.

In spite of every precaution most surgeons will have to occasionally revise a colostomy. The stoma will become narrowed by

stricturing of the fascia and skin around it and it may be necessary to do some type of simple plastic operation on the skin and fascia.

## Ileostomy

One could hardly write about colostomy without a word about ileostomy. Ileostomy isn't as common an operation as colostomy; however, its proper placement and management is fully as important. The ileostomy about which we are interested in this paper is an end type made electively for ulcerative colitis and similar conditions.

There are several other types of ileostomy and one is that for decompression of the ileum. This is done by the Witzel technic of pursestringing a catheter into the ileal lumen. The catheter is pulled through a piece of omentum and held in place at the skin. This type of ileostomy can also be used for traumatic wounds. Of value in extremely ill patients is the loop ileostomy made over a glass rod like a colostomy.

In making an elective end type of ileostomy, we again use the technic as taught by Cattell. The abdomen is opened through a right lower rectus muscle-splitting incision with the upper end at the level of the umbilicus. Depending upon the condition of the patient, the abdominal cavity is gently explored, if at all. The ileum is located and examined for inflammatory changes. The site of the ileostomy is selected about four to eight inches away from the ileocecal valve and the mesentery divided, care being taken not to sever the ileocecal artery. Before dividing the ileum proper, one must decide what type of ileostomy can be done and then know where to locate the stomata. We believe that the functioning proximal limb should be brought through the initial incision and the distal limb placed in the abdominal wall so that it can be excised at a future date if total colectomy is decided upon. Many surgeons feel that this distal end can be closed and dropped back into the peritoneal cavity. One must realize in occluding this distal end of the ileum a closed sac will result if the colon is obstructed by cicatrix. If the stomata cannot be divided, both can be brought through the operative incision. In that case, the proximal limb should extend about 2 in. above the skin with the distal limb much shorter. Obviously, the double barrel ileostomy is not nearly as easy to handle as the single barrel one. A suitable place for the distal or nonfunctioning ileum to come out of the abdominal wall is just to the outside of the rectus muscle and above the original incision. This stoma can be included in a transverse incision for colectomy. If the limbs can be divided the proximal ileum is brought out of the wound

and the wall closed around it. The ileal mesentery is sutured to the anterior abdominal wall intraperitoneally and the bowel is held in place by an Ochsner clamp. There are no sutures taken in the ileal wall because of the possibility of fistula formation. The fascia is closed very loosely and the ileum is at once decompressed with a catheter. The catheter is inserted with several pursestring sutures and it will remove itself in two to three days. This ileal limb is made extremely long and because of this there will be some necrosis of its end. As soon as the catheter is removed some type of constant intestinal suction is begun on the stoma. Postoperatively, the incision is not dressed until it becomes contaminated. At this time some sort of paste or the like is put around the wound. We do not use any type of grease on the abdominal wall. Intravenous fluids and chemotherapy are certainly of primary importance postoperatively.

As soon as possible any suitable stock ileostomy bag can be used over the stoma until the fitted Koenig-Rutzen bag can be utilized. Usually this takes about one month.

The Koenig-Rutzen Ileostomy Bag* has improved the management of ileostomies enormously. The bag has a custom made flat brass rubber covered facing or flange which fits over the ileal stoma and is held in place against the skin for about 3 cm. with a special rubber cement. No skin is exposed for irritation and the cement holds the bag in place so completely that it is water tight and impervious to the ileal fluid. Attached to this flange is the rubber bag. At the bottom of the bag is a vent or spigot which can be folded over and closed with a rubber band. Two bags are supplied, one for day and night, and they are removed every 12 hours with petrolatum naphtha using an eye-dropper. The Koenig-Rutzen bag is made to fit properly, it does not leak, it is easy to remove, and will usually hold 12 hours of ileal fluid (fig. 4).

Dennis[41] thinks that the optimal site for an ileostomy is dictated by the character of the Koenig-Rutzen bag. He places his stoma to the right of the umbilicus about 6 cm. below the belt line, especially in the male, and well away from the anterior superior spine and the inguinal fold. Under local anesthesia the abdomen is opened through a left rectus incision. A segment of ileum is resected for pathological study and both ends of the bowel closed. The distal end is buried in the mesentery to prevent intussusception. The proximal end is brought out through a stab wound at the desired location. Before bringing the ileum through the stab wound, 10 or 12 fine silk sutures are preplaced in the peritoneum and fascia and as

*H. W. Rutzen, 1819 Irvine Park Road, Chicago 13, Ill.

the ileum is brought through the wound, these are sutured to the submucosa and mesentery to prevent torsion and prolapse of the bowel. About 3 cm. of ileum are placed over the skin and a catheter is inserted at once. His paste* is used on the skin and the

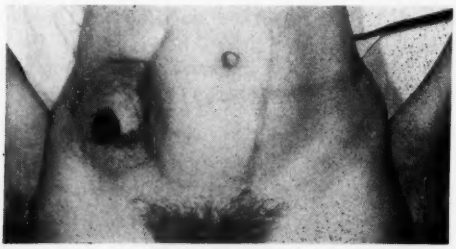

Fig. 4. Ileostomy stoma placed so near the anterior superior spine that a Koenig-Rutzen bag is impractical. This increases the intolerance of an ileostomy.

wound is dressed hourly if necessary. A stock Koenig-Rutzen bag is used for about seven days and the fitted one in about 25 days. As in colostomy if the patient gains weight and the abdominal wall is increased in depth, the stoma seems to funnel down into the skin and it is therefore necessary at the time of operation to lift the skin out and suture it to the bowel.

Ravitch[44] has described an anal-ileostomy. This is accomplished by a pull-through type of operation similar to that done on the colon by Babcock and Bacon.

Cave[45] does his ileostomy through a right McBurney incision. The distal ileum is brought out through a stab wound below and to the left of the umbilicus. This is in line with a long left paramedian incision for colectomy.

After the ileostomy has been functioning, Harvey Stone reopens the abdomen and by a modification of the Finney pyloroplasty makes a type of ampulla in the ileum just proximal to the ileostomy. This seems to act as a storage space.

Lastly, there is the Dragstedt technic of ileostomy where the serosal side of the exposed ileum is grafted with a split thickness graft. This skin covered ileostomy is said to be more easily managed; however, this method does not seem to be as popular today as in the past. One of the difficulties was a cracking of the skin at the junction of the graft with the abdominal wall.

As to the skin care, there are many suggested medicaments. Com-

*Aristol 100, Castor Oil 600, Zinc Oxide 320, Petrolatum 1280.

pound tincture of benzoin painted over the skin several times will make a relatively tough abdominal wall. A very satisfactory paste is that of 10 parts of aluminum powder and 90 parts of zinc oxide. Wyeth has a paste of aluminum and kaolin called protogel. Lassar's paste, ground beef, cottage cheese and Fuller's earth have been used. An aqueous suspension of copper, bronze or aluminum powder will also be satisfactory. Abdominal paste will probably not have to be used after the Koenig-Rutzen bag has been fitted. The terminal ileum seems to assume some of the colon functions and the ileal fluid soon becomes semi-solid. Most patients will then have from four to five movements in one day.

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# CARCINOMA OF THE CERVIX IN PREGNANCY

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CARCINOMA of the cervix is a serious disease with a grave prognosis. When this lesion is complicated by pregnancy the problem becomes even more grave for the risk to both the mother and child is greatly enhanced.

Carcinoma of the cervix complicated by pregnancy poses two problems, namely, the establishment of a correct diagnosis and the application of the proper therapy. In general, the prognosis in this combination of clinical entities is reputed to be extremely poor. This feeling is based upon the past experience plus a belief that pregnancy adversely affects the carcinoma. Certain features bearing on this problem have been evaluated in the light of the experience at the University of Arkansas School of Medicine. This paper reports an analysis of carcinoma of the cervix complicated by pregnancy during the last ten years.

## CLINICAL MATERIAL

From January, 1940, through December, 1949, there were 9,056 deliveries at the University Hospital. Nineteen cases of carcinoma of the cervix were found in this group of parturient women. During this same 10 year period there were 569 cases of carcinoma of the cervix which included the above mentioned 19 cases. Thus, the incidence of carcinoma of the cervix complicating pregnancy is 1 in 477 or .0021 per cent and the incidence of pregnancy complicating carcinoma of the cervix is 1 in 30 or 3.3 per cent. This incidence is to be expected from the age distribution of these two conditions.

The average age of the patients under consideration was 31 years with 11 colored and 9 white patients. This represents the incident race distribution in our clinic. All of the patients were parous as indicated on Table I. As of January, 1950, there were 13 known live mothers and 10 surviving infants.

## CARCINOMA-IN-SITU

Carcinoma of the cervix presents itself in two types of lesions, those which are clinically recognizable by the usual methods of history and examination, and those which are preclinical in type. This

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latter group may be suspected from the clinical appearance of the cervix or from the routine or selected use of smears, scrapings, sponging, etc. A review of the biopsy specimen is necessary to certify the clinical or cytologic findings. The pathologist's analysis of such material usually results in one of the following four diagnoses: a normal gravid cervix, a precancerous lesion, an intra-epithelial carcinoma (carcinoma in situ), or a frankly invasive carcinoma. Our problem is concerned with those patients whose cervical biopsy presents a picture compatible with the diagnosis of intra-epithelial carcinoma and/or a precancerous lesion.

TABLE I

*January, 1940 - December, 1949*

| | | |
|---|---|---|
| Deliveries | | 9056 |
| Carcinoma Cervix | 19 | |
| Incidence | .002% | |
| Carcinoma Cervix | | 569 |
| Pregnancy | 19 | |
| Incidence | 3.3% | |
| Average Age | | 31 |
| Colored 11 White 9 | | |
| Parity—All Parous | | |
| Surviving—Mother 13 | Infants 10 | |

Carcinoma of Cervix in Pregnancy—University of Arkansas School of Medicine, 1940-1949.

The following case reports will illustrate these difficulties in diagnosis. In February, 1949, it was our privilege to see a woman, 38 years of age, pregnant for the first time after 10 years of infertility, in whom a biopsy of a cervical erosion was reported to show intra-epithelial carcinoma. In view of her age and her nulliparity, the absence of a local clinical lesion made a decision on the management of this patient most difficult. A very careful review of many biopsy specimens confirmed the diagnosis of carcinoma, possibly invasive. Fortunately, the patient disappeared from the clinic and was not seen again until she was about seven months pregnant. Examination at this time failed to reveal any clinical lesion and a repeat biopsy showed only changes compatible with carcinoma in situ. The patient was permitted to continue through her pregnancy and she delivered vaginally without incident. An examination of her cervix at six and 12 weeks postpartum failed to reveal any evidence of clinical carcinoma. Biopsy, however, continued to show atypical changes. The cervix was amputated and extensive sectioning made. The findings varied from normal, through basilar hyperactivity, to areas suggestive of carcinoma in situ. Examination of the patient nine months

postpartum showed no evidence of local lesion and a biopsy of the cervical stump was entirely normal.

This patient aroused our interest in this problem and random biopsies were taken on 100 normal pregnant women scattered throughout their pregnancy, the earliest at eight weeks and the latest at 35 weeks of gestation. This random sampling produced 3 additional cases in whom the tissue changes were sufficiently atypical to be classified by the pathologist as carcinoma in situ, and 33 others in whom there was considerable basilar hyperactivity of a confusing type (Table II).

TABLE II

| | | |
|---|---|---|
| Gravid Women Studied | | 100 |
| Duration of Pregnancy, 8-35 weeks | | |
| Atypical Hyperplasia | 33 | |
| Carcinoma in situ | | 4 |
| OUTCOME | | |
| Delivered Vaginally | | 4 |
| Follow-up | | |
| Normal Cervix | 2 | |
| Persistence | 2 | |

100 gravid women selected at random during pregnancy for cervical biopsy. The picture of carcinoma in situ disappeared postpartum in 2 of the 4 patients.

All four of these patients were delivered vaginally without incident, and follow-up examination has failed to reveal any evidence of clinical or invasive carcinoma. Two of the patients continued to show changes compatible with intra-epithelial carcinoma; in the other two these findings have disappeared.

In 1949, Novak, in a discussion of the diagnosis of carcinoma of the cervix, indicated that certain carcinoma-like pictures were found in pregnancy which were essentially indistinguishable from carcinoma and appeared to regress spontaneously following delivery. In the discussion of his paper, several others described similar experiences. Johnson recently reported 2 cases of carcinoma in situ during pregnancy in which the condition either disappeared following cauterization or regressed in the puerperium. Younge and his associates have reported 6 cases in which pregnancy was associated with carcinoma in situ where reproductive function had been preserved by simple cauterization of the cervix. Hirst has recently reported a case of carcinoma in situ treated by radical hysterectomy in the early puerperium only to find a negative cervix even on serial sectioning.

The diagnosis of early (intra-epithelial) carcinoma of the cervix during pregnancy is, therefore, very uncertain. Many of these very

early lesions which appear malignant during the course of pregnancy apparently regress following gestation. It would seem wise, therefore, to use extreme conservatism in the management of these conditions in young women. The selection of the final treatment of these patients should be determined not so much by the stage of the disease as by the age and reproductive wishes of the patient. In women with many children, the puerperal removal of the uterus for a suspicious, intra-epithelial or precancerous lesion may be justifiable as a prophylactic procedure. However, in young women desiring future children, the conservation of the uterus and the local treatment of these equivocal lesions seems to be in order.

It appears, therefore, that the diagnosis of carcinoma in situ during pregnancy is very difficult. Many apparently malignant changes may be reversible; beware of an in-situ or equivocal report by the pathologist during pregnancy. Conservatism should be practiced in young women with a limited number of children.

## Clinical Carcinoma of the Cervix

Clinical or invasive carcinoma of the cervix is less confusing. The diagnosis of this condition in pregnancy is occasionally complicated or delayed by the confusion of symptoms associated with the two conditions. The initial prenatal examination of the gravid woman should include careful palpation and inspection of the cervix even though her gestation may be well advanced. As indicated on the tables, bleeding and discharge are the common symptoms of carcinoma of the cervix in pregnancy as in the non-gravid state. The all too frequent assignment of the cause of bleeding as an obstetrical complication leads to the delay in diagnosis and treatment in many of these patients. Table I presents the statistical information deal-

TABLE III

*Stage and Symptoms*

| | |
|---|---|
| Carcinoma in situ | 2 |
| Stage I | 10 |
| Stage II | 4 |
| Stage III | 2 |
| Stage IV | 1 |
| Total | 19 |
| Symptoms | |
| Bleeding and Discharge | 16 |
| Average Duration, 2 months (Range 1-14) | |

Distribution of stage and duration of symptoms in 19 cases of carcinoma of cervix in pregnancy.

ing with these 19 patients. It is regretted that many patients had an excessive loss of time following the onset of symptoms prior to the onset of treatment. The average of two months for the entire group is compatible with other figures on time loss (Table III).

It is well known that the younger the patient when the diagnosis of carcinoma is made the poorer the prognosis. While in pre-invasive or intra-epithelial carcinomas, age may play a role in the selection of treatment, in clinical or invasive carcinoma this feature must be disregarded. The two most important items in the selection of treatment of clinical carcinoma is the stage of the disease when the patient is first seen, and the duration of her pregnancy. In general, patients with advanced carcinoma do not conceive readily because of the large local tumor. Hence, most of these patients are seen in an early and, therefore, relatively favorable stage (see Table III). In the early part of this series the patients have been under the care of a large number of attending men. During the last three years a standardized form of treatment has been employed with considerably improved results.

Three methods of therapy are available here singly or in combination, namely, x-ray, radium, and surgery. In the 5 patients seen prior to 1945, only 1 patient survived three years. Of the 5 patients seen in 1946 and 1947, all survived three years. This program has not been in effect long enough to permit adequate five year analysis (Table IV).

TABLE IV

*Three Year Survival*

| | |
|---|---|
| 1940-1945 | 5 Cases |
| 3 yr. Survival | 1 (20%) |
| 1946-1947 | 5 Cases |
| 3 yr. Survival | 5 |

All Stage III and IV cases were seen after 1947

During the later interval the following principles have been employed. If the patient were early in her pregnancy, the infant was disregarded and x-ray and radium therapy applied through external ports and intravaginal applicators. During the course of treatment a spontaneous abortion occurs and in our experience has been terminated without complication. Following the abortion, therapy is continued in accordance with the usual principles for the treatment of carcinoma of the cervix.

In the patients advanced in their pregnancy, the management has been more variable. If the child were near viability, some delay in complete therapy has been employed to permit the child to approach

viability. In one instance x-ray and in another instance radium was applied during this interval. The pregnancy was terminated by a hysterotomy when viability or term was reached. In three instances a hysterectomy accompanied the hysterotomy. Following the emptying of the uterus, x-ray and radium therapy have been applied in the usual fashion. Complications following this method of treatment have been minimal ascribable to the concomitant presence of carcinoma and pregnancy or to the treatment thereof. One mother who entered the hospital almost moribund expired on her third postoperative day following a Porro Section. No cases of serious hemorrhage or infection occurred in this group.

TABLE V

*Principles of Treatment*

| | Pregnancy | |
|---|---|---|
| *Lesion* | *Early* | *Late* |
| In Situ | No Rx | No Rx |
| Early | X-ray<br>Radium | Radium<br>Porro<br>X-ray |
| Late | X-ray<br>Radium | Porro<br>X-ray<br>Radium |

Plan of therapy of carcinoma of cervix in pregnancy employed since 1948.

The current methods of therapy is summarized in Table V. In early pregnancy with an early lesion, the carcinoma is treated without regard to the pregnancy, usually by irradiation which induced fetal death and a spontaneous abortion. In late pregnancy, an early lesion may be treated by local irradiation pending the arrival of fetal viability at which time a hysterotomy is performed. A hysterectomy may be combined with this procedure under certain selected circumstances. In late pregnancy with an advanced disease, palliative therapy to the local lesion is all that is indicated pending viability of the child when a cesarean hysterectomy should be done. This should be followed by deep x-ray therapy in the usual manner. The prognosis here, as with all advanced carcinomas, is poor. Employment of cesarean hysterectomy avoids the complication of hemorrhage and infection which might follow other methods of termination of pregnancy.

## Discussion

This experience with carcinoma in the cervix tends to confirm that reported by other investigators. When one considers this problem

certain questions naturally arise. Does carcinoma of the cervix adversely affect the pregnancy? Does the pregnancy adversely affect the carcinoma? Does the simultaneous appearance of these two conditions complicate the management of either of them?

The evidence at hand tends to suggest that the pregnancy does not seriously affect the course of the carcinoma when proper treatment is applied and there is little evidence to suggest that the carcinoma adversely affects the course of pregnancy. Unrecognized carcinoma or improperly managed delivery of a carcinomatous patient may provoke the extremely hazardous complications of severe hemorrhage and/or infection.

The management of carcinoma of the cervix detected early in pregnancy is not adversely influenced by the presence of the pregnancy. However, the existence of carcinoma in late pregnancy seriously complicates the management of both the carcinoma and the pregnancy. The prognosis in these conditions appears to be dependent more on both the stage of the disease and the method of termination of the pregnancy than any of the other factors.

## Conclusion

In conclusion, this analysis of 19 cases of carcinoma in pregnancy seen at the University of Arkansas tends to suggest that carcinoma in situ in pregnancy is a difficult diagnosis to make and that many *apparently* malignant lesions are reversible. Conservatism in the management of these women with careful puerperal evaluation is in order.

Clinical carcinoma of the cervix should be suspected whenever there is bleeding or discharge during the course of the pregnancy. The treatment should be eclectic, employing x-ray, radium, and surgery in accordance with the stage of the disease and the duration of the pregnancy.

The prognosis of carcinoma of the cervix in pregnancy has been poor, but can be greatly improved by the judicious selection of time and mode of treatment.

# THE IMPORTANCE OF HISTOLOGIC EXAMINATION OF MINIATURE PATHOLOGIC LESIONS

## A Brief Discussion of Fifteen Illustrative Cases

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AS THE title of this paper indicates, nothing particularly new will be presented. Moreover, I am certain that every one of you knows of duplicate instances, almost case for case, comparable to those that I will discuss. The very pertinent question therefore arises: why bore you gentlemen reiterating the obvious? One reason is that almost all of the cases I will show have been encountered in the past two or three years and they frequently represent but single examples of numerous similar cases in the same time interval. Likewise, this time interval is no different in my experience from the preceding 25 years, during which period similar types of cases were encountered year after year. Furthermore, the great majority of these specimens were submitted by surgeons of superior scientific stature. My second reason is not to emphasize, particularly, errors of omission but to re-emphasize the well-known fact that very often valuable clinical and prognostic information is revealed by histologic study of apparently quite unimportant, innocent-appearing lesions. In many of these cases such microscopic revelations were wholly unsuspected by either surgeon or pathologist. Again, this latter observation is certainly trite. Nevertheless, we all know that a surgeon's interest naturally is inclined to be focused on major pathologic problems, and both he and the pathologist are sometimes disposed to minimize the occasional, far-reaching, hidden potentialities of tiny, seemingly innocent blemishes and nodules. Furthermore, even with larger lesions we are prone, at times, to rely on what appears grossly obvious, only later to regret deeply that histologic study was not carried out. An attempt will be made to cover the above introductory points and others of surgical and pathologic significance in the following case discussions.

The highlights of 15 illustrative cases will be discussed under the following captions: (1) Small and seemingly insignificant, innocent-appearing nodules and lumps, (2) Apparently trivial, small, asymptomatic "cysts," (3) Insignificant, ostensibly benign, non-disfiguring superficial blemishes, and (4) Very small epithelial surface defects in either continuity, color, or both.

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## Case Reports

*Group 1.* Small and seemingly insignificant, innocent-appearing nodules and lumps.

Case 1. Mrs. K., age 65, had been bothered with a small lump the size of a pea in the post-auricular region. She requested that this small tumor be removed, although it was so insignificant that the surgeon had to be urged by the patient. We found a metastatic squamous cell carcinoma in a lymph node. A very thorough search of all possible primary sources revealed a miniature lesion in the right anterior ethmoid region. This case serves to emphasize the importance of small and apparently harmless lumps.

Case 2. Miss D., age 36, suffered a glass injury to the arm which produced a foreign body reaction. This was removed and dusted with sulfathiazole. A tumor later appeared in the scar which grew slowly. This, also, was a foreign body type of lipogranulomatous reaction containing many giant cells, often with engulfed crystalline material. At first glance, the lesion superficially resembled Boeck's sarcoid.

It is not at all an unusual experience, when a benign tumor has been removed from soft tissue, that traumatized fat will be liberated in the area, producing a lipogranuloma. We see these little lesions very frequently, either following injections or trauma of other varieties. It does not seem to be appreciated adequately that liberated fat may act as a foreign body. This is especially true if crystals of fatty acids or soaps are formed. Moreover, some patients have been subjected to excessively wide surgical resection when such granulomas have appeared following the removal of a benign tumor, under the mistaken impression that these granulomas constitute a malignant recurrence.

Case 3. Mr. L., age 50, had had a small subcutaneous tumor of the middle outer aspect of the right thigh. He had known of its presence for approximately 20 years and had been repeatedly informed that he should have it removed. It had measured about 1.5 cm. in diameter and showed no increase in size until about eight months prior to his death, when it began to grow rather slowly. Because he was away from home, he postponed seeing a physician for some time. When next examined, the tumor was easily the size of a lemon; it was covered with tight, shiny, hyperemic skin, and showed sloping borders. A wide resection was done but the tumor was found to have extended deeply. X-rays of the lungs revealed countless metastatic deposits. He lived for about two months.

The tumor has the structure of a neurogenic sarcoma and these are particularly treacherous since there is such a strong tendency for apparently benign neurofibromata to lie dormant for long periods of time and then suddenly spring into savage malignancy. This is particularly true, of course, of multiple neurofibromata. In Hosoi's series of 466 cases collected from the literature,[1] 59 (or 13 per cent) developed malignant tumors, usually in old growths of long standing. Certainly this is entirely too high a percentage of malignant transformation to disregard their very serious potentialities.

Case 4. Mrs. E., age 39, observed a solitary gland in her axilla. Careful examination of the breast revealed no palpable tumor. The gland was removed and a diagnosis of metastatic carcinoma with morphology fairly classical of metastatic breast cancer was made. Again the breast was carefully examined

and nothing was found. However, radical resection was done and a miniature carcinoma 5 mm. in diameter was found in the midportion of the breast lying in the deepest portion of the breast tissue right on top of the pectoral muscle.

In the past year I have encountered 3 such cases and in my experience this has not been a particularly rare occurrence. Naturally, one must be fairly certain of the cell type since axillary metastases do occur from distant malignancies other than the breast, and under such circumstances an unnecessary, mutilating operation would be carried out. However, the possibility of a nonpalpable miniature lesion should always be kept in mind and when the morphology of the axillary lesion is fairly distinctive, I think we are justified in doing a radical breast operation.

CASE 5. Mr. S., age 48, was first observed in 1939 with some elastic, somewhat enlarged, non-matted glands in the right groin. Biopsy revealed a diffuse type of small cell, non-follicle-forming lymphosarcoma. The glands were resected since no other foci of glandular enlargement were found, and the patient was then subjected to aggressive, local, external irradiation. He remained well for 11 years when he appeared with several enlarged glands in the left groin, the largest about the size of an unhulled black walnut, which had been present about two months. Biopsy at this time showed the classical histologic picture of Brill-Symmers giant follicle lymphoma. Wide local resection was carried out again, followed by heavy external irradiation. The interesting features of this case are two. First, it possibly serves as an example of the better results which have been reported from different clinics when a combination of surgical eradication and irradiation are used in instances of localized malignant lymphoma as opposed to x-ray alone. This man has now been six months without evidence of recurrence, either locally or elsewhere. The second point of interest is the apparent change in the morphology of the growth in the right groin and the left groin.

This interrelationship of the lymphomas has recently been emphasized by Custer's study of 1,330 patients.[2] Many of these cases had serial biopsies and autopsy. Custer saw transitions from one microscopic type to another in nearly 40 per cent of this group of cases and he also encountered several different microscopic patterns, often present in the same person and even in the same lymph node. He has grouped under the caption of lymphoma the three types of Hodgkin's as classified by Jackson and Parker, the lymphatic leukemias, lymphosarcoma, reticulum cell sarcoma, follicular lymphoblastoma, monocytic leukemia, mycosis fungoides and Spiegler-Fendt sarcoid. I might add that I have likewise seen such interesting interrelationships on several occasions, this being particularly true in my experience in lymphosarcoma and lymphatic leukemia, Brill-Symmers and lymphosarcoma, and reticulum cell sarcoma and varying types of Hodgkin's granuloma.

*Group 2.* Apparently trivial, small, asymptomatic "cysts."

CASE 6. Mr. P., 60 years of age, had a wen in his cheek for many years. It had become infected on two or three occasions and on the last occasion broke down, drained and refused to heal. The tumor was not much larger than a Bing cherry. It was resected and found to be histologically malignant with frank squamous cell carcinomatous transformation of the wall of the cyst and invasion of the surrounding tissue.

This case illustrates a fact with which you are all familiar; namely, that simple wens are not always so simple. In my material I will see five or six

such malignancies every year and in practically all instances the presence of either basal or squamous cell malignancy superimposed on these cysts is totally unsuspected. Moreover, the metastatic proclivities of these squamous cell cancers is in all respects similar to primary squamous cell malignancy of the skin.

CASE 7. Mrs. C. was first seen by me 13 years before her death, when she was about 25 years old. There was a swelling of the right mandible. She gave a history that some years previously she had had a swelling here and a dentist had scraped it out, telling her that it was a simple cyst. X-ray on first examination showed a multiloculated cyst involving a large portion of the right mandible. An attempt was made for wide excision. After repeated recurrences over a period of 13 years, with operations consisting of resection of the mandible and later resection of the maxilla, she died with extension to the brain and meningitis.

The lesson to be learned here is that adamantine epithelioma may appear as a single small cyst and that all cysts should be examined histologically, since it is more or less axiomatic that if these tumors are to be cured they must be resected widely when they are small. Her chances for cure were lost when the first operator failed to recognize the character of the lesion by not having the tissue examined. Several similar cases have come under my observation.

CASE 8. Mr. S., a 54 year old attorney, noted a small tumor of the scalp 1 inch to the left of the midline in the parietal region, which measured about 3 by 2 cm. He thought it was a wen but his wife insisted on his having it removed. At operation it appeared to be capsulated but histologic examination revealed penetration of the capsule and galea by myxomatous elements. He was advised to have a wide resection of the scalp and skull since the tumor had penetrated through the galea. However, after several consultations he elected to wait and see if it had not been cured by the local resection. He subsequently developed signs of slow paralysis of the right arm and later convulsions. A scalp flap was made and a recurrent tumor was found in the scalp which had penetrated through the skull and meninges and involved the brain. Wide local resection of scalp, skull, meninges and involved brain was carried out. However, he subsequently died from widespread metastases. He probably lost his opportunity for cure by waiting several months before he had a wide excision of the local lesion.

CASE 9. B. J., a 6 year old girl, had a swelling of the left mandible. It was opened for a cyst. An apparently expansile myxomatous growth was found and the area was thoroughly curetted. It was diagnosed as a benign lesion by an excellent pathologist and the parents were told that it was nothing to worry about. Within a few months the jaw had become widely invaded by the tumor. The left mandible was resected and disarticulated but local recurrence was prompt and the patient was sent to Memorial Hospital in New York where the tumor was considered hopelessly advanced.

*Comment:* These 2 cases of myxosarcoma will serve to illustrate that the determination of behavior of this group of tumors by microscopic study is not at all satisfactory. In the first case, the invasion of the galea was the give-away. In the second case, the absence of

histologic invasion, possibly based upon the fact that the entire specimen was not submitted for microscopic study, led the first pathologist to be too conservative in his opinion. A good rule of thumb in this relatively uncommon group of neoplasms, however, is that predominantly myxomatous tumors should usually be regarded as malignant. Histologic differentiation on cell type alone is even more futile than with the fibromatous, collagen producers of mesoblastic origin.

CASE 10. Mr. W., a 58 year old, heavy, machinery executive, had a small "cyst" behind the right ear. He consulted a surgeon who removed the "cyst" in the office and did not have it examined. One year later the growth recurred in the form of a subcutaneous lump which measured about 3.5 cm. in diameter. He consulted another surgeon who removed it under local anesthesia in the emergency room of the hospital. Because of the fact that he found it apparently infiltrating and was not sure, because of its high cellularity, whether or not it had all been removed, he decided to have it examined. The histologic picture was that of a highly malignant, amelanotic melanoblastoma. The patient was immediately advised to have a wide resection and possible glandular dissection. However, he consulted a friend who assured the patient that the lesion was probably trifling. Six months later, after the patient had publicly ridiculed the surgeon and the pathologist who "just wanted to cut on him," he discovered a gland in his neck and took a plane to New York where a resection was instituted. However, very soon the tumor had widely disseminated and he died from metastasis. Part of this history is second-hand but is as accurate as I have been able to ascertain from various friends who, because of his prominence, interrogated me and gave me this information. I do not think we need dwell on the moral in this case.

*Group 3.* Insignificant, ostensibly benign, non-disfiguring superficial blemishes.

CASE 11. Mr. X, age 26, had noted for many years a small, slightly raised, pigmented mole on his neck beneath the right ear. There had been no change in the growth. His mother was a social service employee at the hospital and had heard about the possible malignancy of these pigmented moles and requested that her son have it removed, which was done. The diagnosis was malignant, pigmented, spindle form, dermal nevus.

At about this same time, there appeared an article in *Cancer* on the "Reorientation on the Histogenesis and Clinical Significance of Cutaneous Nevi and Melanomas,"[3] wherein was discussed benign variants of the blue nevus which "because of their rich cellularity and striking abundance of melanotic pigment are often misdiagnosed as melanosarcoma." The author apparently was of the opinion that "when such intradermal nevi are associated with malignant melanoma, such malignancy must have arisen from epidermal or junctional element." The author also seems to think these tumors do not become malignant unless junctional elements are present. This was the assumption, also, of the surgeon who removed the mole.

The patient, however, was kept under strict surveillance and one and a half years later a small gland was palpable at the angle of the jaw. A wide resection of the neck was done. The palpable node revealed metastasis. This case

shows the fallacy of making hard and fast rules about any neoplastic process. Furthermore, I am firmly of the opinion that when such atypical morphologic variants are found in this type of dermal growth, they must be regarded as either malignant or potentially malignant and resected with a wide border. Furthermore, if they are removed from the extremities, axillary or inguinal dissection probably should be instituted.

CASE 12. Baby G., 16 months old, had a small, very black mole on his scrotum since birth. It was removed and found to be histologically malignant. This very interesting group of juvenile melanomas, which occur about equally in both sexes, show slow or sometimes rapid growth, they are usually hairless, and rarely are ulcerated. Microscopically, the section showed nuclear variation, changes in cell type and mitotic figures.

This group of tumors deserves special consideration because histologically they are often frankly malignant. However, clinically, these tumors practically never show metastasis until after puberty, at which time they may undergo rapid growth and metastasize widely. This is particularly true of those on the hands, soles of the feet, under the nails and on the genitalia. The extreme importance of knowing the age of the patient in such clinically benign but microscopically malignant lesions needs no further comment.

*Group 4.* Very small, epithelial surface defects in continuity, color, or both.

CASE 13. Mr. H., 54 years old, had a pale white, scaly, superficial spot about 4 mm. in diameter on his lower lip for about a month. It was flat, non-indurated, and had all the appearances of a benign leukoplakia. A clinical diagnosis of leukoplakia was made and he was advised to have it removed. Microscopically, this tiny white spot showed carcinoma in situ. There was as yet no invasion beyond the epiderm, although there was definite acanthosis and dyskeratosis together with the frank nuclear changes of malignancy.

Demonstration of this case would seem obvious. My only reason for showing it is that even cases of very small, apparently harmless, leukoplakic spots of very short duration may now and then be already microscopically malignant. These are usually cured by superficial resection or cauterization. I am also showing this case because I have been greatly interested to know why in the management of small "in situ squamous cell carcinomas" growing on the mucous membrane of the portio cervix we should be so much more radical than with these very small, histologically identical, superficial lip lesions.

CASE 14. Mrs. M., a 36 year old married woman with four children, was a very prominent worker in the local Cancer Control program. A small area about 2 mm. in diameter on the lip of the cervix was discovered on routine physical check-up. This lesion was carefully watched for one year without any increase in size. Biopsy showed a miniature focus of carcinoma in situ. The

patient demanded hysterectomy. Step sections of the cervix revealed no other similar focus.

We have seen several similar cases as well as some with multicentric foci of in situ carcinoma, and this poses the very important problem of whether or not thorough cauterization might not be, in certain cases, adequate treatment. There is much discussion and also considerable confusion at present over the management of these miniature in situ malignancies.

CASE 15. Dr. L., 58 year old veterinarian, had been troubled with diarrhea for four years. He is an excessively high strung and nervous individual and had had numerous gastrointestinal surveys and repeated proctoscopic examinations at different clinics since the onset of his diarrhea because of his fear of cancer. Two years ago, on proctologic examination, a small, barely visible ulcer was discovered in the rectal ampulla. This was resected with a good border and found to be an extraordinarily early, invasive adenocarcinoma. This tumor is doubly interesting. First, it illustrates that cancers may spring de novo as minute, ulcerative lesions in the absence of any polypoid overgrowth or adenomatous hyperplasia. Moreover, repeated proctoscopic examinations and gastrointestinal surveys had previously been negative. Only the patient's seemingly undue apprehension about his bowels led to the early discovery of this minute cancer. Frankly, this is the earliest such lesion that I have ever seen. It was easily possible to incorporate the entire lesion in the No. 3 microscope objective. The patient entered the hospital last month for removal of his gallbladder which was filled with stones, and there was no evidence of his cancer. Furthermore, his diarrhea has improved greatly.

## CONCLUSIONS

1. Fifteen cases are briefly presented to emphasize the importance of microscopic study of small clinically unimpressive lesions.

2. These cases have been divided into four groups:

   A. Insignificant appearing nodules.

   B. Small, apparently trivial "cysts."

   C. Ostensibly benign, superficial blemishes.

   D. Miniature surface defects.

3. The serious, hidden implications of these clinically innocent-appearing lesions are pointed out with short comments.

To quote my good friend, Dr. Frank D. Dickson, international orthopedist, "it is sometimes more profitable to re-explore old pathways than eagerly to pursue the new and uncharted."

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# MESENTERIC VASCULAR OCCLUSION AND DUODENAL INFARCTION

## With Report of an Unusual Case

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THE dramatic acute abdominal condition produced by a mesenteric vascular occlusion is known to all surgeons but is still more frequently diagnosed at the surgery or autopsy table than at the bedside. The very severity of this condition obscures the fact that many minor mesenteric vascular conditions go unnoticed. McClenahan and Fisher[1] point out "that mesenteric thrombosis occurs more commonly in a milder form than is often appreciated, accounting for many vague abdominal symptoms in older people without there necessarily being a massive abdominal accident. The picture may be compared to 'angina' caused by coronary insufficiency, 'cerebral spasm' which results from cerebral circulation insufficiency, or 'intermittent claudication' due to insufficiency of the circulation of the extremities."

With this conception of mesenteric vascular damage it is strange that only some 600 cases of the classical occlusive vascular condition have appeared in the literature since Tiedemann[2] made the first report in 1843.

Virchow[3,4] then gave, in 1847 and 1854, the first explanation of the underlying pathology of thrombosis and embolism. Elliott[5] reported the first successful intestinal resection for this condition in 1895, but by 1921 Klein[6] was able to find only 24 successfully resected cases. Later case series[7,8,9,10,11,12] only testify to the high mortality rate of this condition in spite of better diagnostic methods, improved surgical technics, antibiotics, and anticoagulants.

Reports of massive involvement and massive resections fail to mention specifically infarction of the duodenum, although mention is made of its possible etiological relationship to duodenal ulcer;[13] and reports of occlusion of the portal vein[14] would seem to necessitate this occurrence. Because of this previously unreported condition the case herein reported is of unusual interest.

### ANATOMY AND BLOOD SUPPLY

An understanding of the anatomy and blood supply of the duodenum and small intestines makes clear why an infarction of the

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duodenum would be a rare occurrence. The duodenum is a retroperitoneal organ after the first three and one-half inches as it borders the head of the pancreas until it emerges from beneath the ligament of Treitz. Embryologically it arises from the foregut

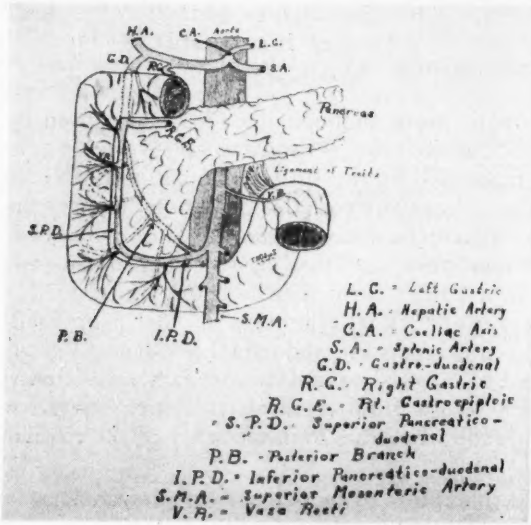


Fig. 1. Blood supply of duodenum.

which receives its blood supply from the celiac axis. The remainder of the small intestine and the right half of the colon being mid-gut is supplied by the superior mesenteric artery. Because they suspected ischemic necrosis might be a major factor in postgastrectomy stump leakage, Shapiro and Robillard[15] undertook an extensive study to determine the duodenal blood supply accurately. They found the most common arterial supply to be from two arterial systems (fig. 1): (1) the gastroduodenal arising from the hepatic branch of the celiac artery and dividing to form the right gastroepiploic artery and the superior pancreaticoduodenal artery; and (2) the inferior pancreaticoduodenal artery which arises from the superior mesenteric artery. The two systems anastomose freely to form a very judicious blood supply to the duodenum. The remainder of the intestinal canal is supplied by the superior and inferior mesenteric arteries which anastomose freely at their confluence (fig. 2).

Venous drainage from the duodenum and pancreas is somewhat variable, but Pierson[16] and Wharton[17] report that the anterior-superior pancreaticoduodenal vein always drains into the right gas-

troepiploic vein which joins the superior mesenteric vein (fig. 3). The posteriorsuperior pancreaticoduodenal vein usually drains into the portal vein, although it, too, often enters the superior mesenteric vein. The inferior pancreaticoduodenal vein almost always drains into the superior mesenteric vein. Sometimes the superior pancreaticoduodenal veins are absent according to Shapiro and Robillard.[15] It is well to remember that the inferior mesenteric vein empties into the splenic vein.

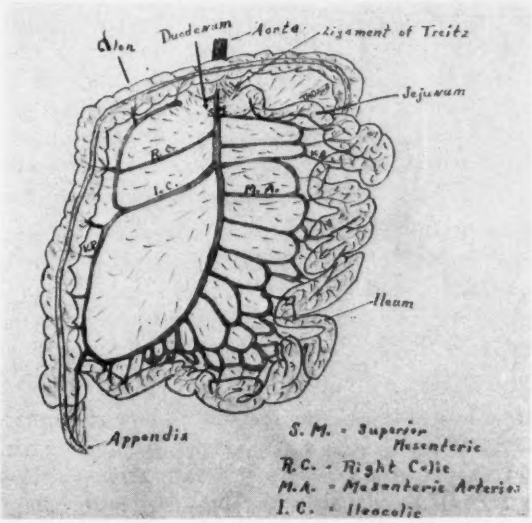


Fig. 2. Blood supply to the small intestine.

The lymphatics of the gallbladder and pancreas are closely associated and this in part accounts for the frequency with which both organs are involved in disease at the same time. Since the common duct enters the second part of the duodenum after traversing varying amounts of pancreatic tissue, accompanying lymphatics in effect connect the hepatic glands with the subpyloric group of glands which are found at the bifurcation of the gastroduodenal artery.

## Etiology and Pathogenesis

Infection is the most common underlying cause of mesenteric venous thrombosis, the secondary phlebitis resulting in a proliferating thrombus. Trauma, blood dyscrasias and mechanical pressure from tumors, adhesions, volvulus, and strangulated hernias are frequent causative factors.[12] Less frequent sources are Buerger's disease and invasion of the vessel by cancer cells.[18]

Arterial occlusion is most usually associated with cardiovascular diseases that produce emboli or atheromatous thrombi. A recent causative factor is reported as following lumbar sympathectomy.[10,19]

The pathological result of occlusion of either the artery or vein is hemorrhagic infarction of the part of the gut involved. Venous

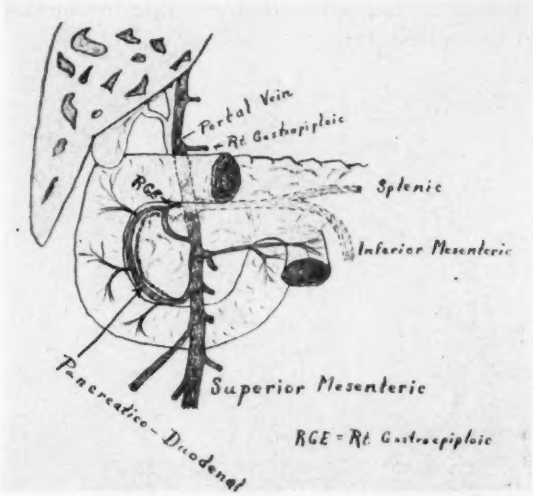


Fig. 3. Venous drainage of duodenum.

occlusion is often an insidious affair that starts with capillary involvement and spreads to increasingly larger radicles until the entire small intestine may become involved. As soon as collateral circulation is stopped anoxia, infarction, increased permeability and intraluminal bleeding occurs. The bowel muscle is relaxed and intraluminal loss of blood and fluids is undoubtedly a major contributing cause of death.

Arterial occlusion is usually a sudden affair with an immediate spasm of the bowel.[20,21,22] This spasm produces an anoxia of the bowel wall and eventual muscle fatigue with relaxation and a resulting increase in permeability. Thence venous blood passes into the bowel to cause the characteristic hemorrhagic infarction. Surgery during the spastic stage is uncertain because as yet there is no definite line of demarcation to guide in the area to be resected.[23]

## Diagnosis

Undoubtedly the most important single factor in the diagnosis of any condition is to simply think of it. This failure to consider the

possibility of mesenteric vascular occlusion is probably the major reason only a small percentage of cases are diagnosed prior to surgery or death. Generally the outstanding clinical symptom is pain and discomfort out of proportion to the physical signs. Shock symptoms with a sudden onset occur with arterial occlusion. Nausea and vomiting are usually present often simulating intestinal obstruction. Tenderness and rigidity in the early stages are likely to be conspicuously absent. A mass becomes palpable as infarction advances. Blood in the stool is valuable evidence if found but is often not present. This may be found only by rectal examination. Hematemesis is infrequently mentioned as a finding but since this was a notable feature of the case to be presented, noted as blood in the contents removed by suction, this feature of an infarction of the upper bowel may well be an important piece of evidence. It would seem that this might well be more frequently noted by the farther reaching Miller-Abbott and other similar tubes.

Although acute onset is the rule, the process may carry on over a period of days with venous occlusion.[24,25,26] Fever may not be an early finding. There is usually a leukocytosis. X-ray may give important information if a distended gut is seen to become abruptly normal in the middle of the transverse colon and barium enema shows no obstruction.[11]

The situation is well summarized by Warren and Eberhard[12] with these words: "Sudden, severe abdominal pain, accompanied possibly by vomiting, with diarrhea or sudden constipation, shock, subnormal temperature, a high leukocytosis, possibly with blood in the stools, and with diligent search presenting a predisposing cause, should always make the clinician include thrombosis of the mesenteric vessels among his possible diagnoses."

Differentiation from ruptured viscus, acute cholecystitis, acute pancreatitis, intestinal obstruction, strangulation or torsion of a viscus, ectopic pregnancy, and blood dyscrasias then provides the final answer before surgery or death.

## Prognosis

Prognosis at best is poor; but with improved surgical technic, antibiotics, anticoagulants, and a better understanding of the fluid requirements of the body we should look forward to a more successful termination of these cases. Early recognition and early operation will be the most important things. A 25 per cent mortality rate which is near minimal has been reported on those cases operated upon within the first 12 hours.[12] Anticoagulant therapy alone has produced some survivals and will be of unquestioned help in the

management of these cases.[27] More massive resections are being done with survival. A condition that may be successfully treated if recognized in time, yet carries an over-all mortality of upwards of 80 per cent, should be a challenge to every clinician who sees abdominal conditions of any nature.

The following case illustrates some of the many variations and bizarre manifestations the condition may assume. In addition it presents an hitherto unrecorded involvement of the duodenum. We wish to emphasize one important observation that may well be utilized in future case studies for diagnosis, that of blood in the suction contents of the stomach. It is regrettable that a postmortem examination could not be had for a more accurate study of the underlying factors.

### Case Report.

Mrs. B. A. (12774), was an obese, 56 year old farm woman, the mother of six children. She entered the hospital with the chief complaints of abdominal distress and pain, gaseous eructation, constipation, and frequent attacks of nausea and vomiting, there being no relationship to time, amount or kind of food eaten except fats.

She stated these symptoms had existed for 30 years in varying degrees and that she had been treated by some 10 or 12 different doctors, clinics and hospitals. Her latest treatment was a Sippy diet which definitely increased the symptoms. She appeared mentally clear and alert, not acutely ill and gave a multitude of non-essential details reminding one of a psychoneurotic.

General examination revealed a mildly dehydrated woman with normal temperature, pulse and respiration. Blood pressure was 148/90. Chest and heart were negative. There was a mild tenderness over a palpable liver and in the epigastrium. A large ventral hernia, prolapse of the vagina, cystocele and rectocele existed following a subtotal hysterectomy for fibroids.

Laboratory findings: Hemoglobin 86 per cent (12.4 Gm.), red blood count 4,900,000, white blood count 7,600 with a normal differential. Kahn and Kline were negative. Urine: acid, Sp. Gr. 1.015, albumin and sugar negative, acetone 1 plus, with an occasional W.B.C./h.p.f. Gastric analysis was negative for blood and bile with a free Hcl. of 18 degrees and a total acid of 27 degrees.

X-rays showed a poorly filling, lightly concentrated, non-emptying gallbladder with no stones. Oral barium revealed a narrow tubular stomach with no filling defects or niches. There was a small four hour residual with the head of the meal at the hepatic flexure. Barium enema was normal.

She responded rapidly to fluids, antispasmodics and bile acids (Ketochol R) and was discharged in three days at her request to return for a later cholecystectomy at our advice.

Three days later she returned with severe nausea but no pain with temperature of 99° F. In 12 hours her temperature arose to 100.4° F. and she complained of severe unlocalized abdominal pain. General examination was as before.

The next three days were filled with constant complaints of abdominal and back pains, and evidently increasing toxicity with severe restlessness and apprehension. At the same time the temperature and pulse were at normal levels, vomiting stopped, she ate small amounts, bowel sounds were normal, the bowels moved well by enemata, and no tenderness, masses, or rigidity could be elicited. On the evening of the third day nausea, vomiting and distention developed. Wangensteen suction was instituted and the next day blood was recovered by suction.

On the fourth day the temperature arose from 99.4° F. to 102.4° F. with a pulse increase from 80 to 120. White blood count 24,000 with 88 per cent neutrophiles. The complaints increased in severity but it was not until the following, or fifth day, that a tender mass was found in the left upper quadrant. The temperature ranged from 101° F. to 102° F., the pulse from 88 to 120. White blood count 17,200 with 88 per cent neutrophiles. Fluids, plasma, whole blood, and antibiotics were being given liberally. The patient was desperately ill and we felt we were dealing with an abscess and surgery was decided upon.

Light $NO_2$-ether anesthesia was given and the abdomen was opened through an upper left rectus incision. We immediately met a considerable amount of serosanguineous fluid and a heavy, distended, dark bowel, the characteristic picture of mesenteric thrombosis. This very damaged bowel extended beneath the ligament of Treitz and the duodenum could be followed as an indurated doughy mass as it coursed across the back retroperitoneally. The stomach appeared quite normal to the pyloric ring but from that point onward the ominous black duodenum passed through dense adhesions about the gallbladder to its retroperitoneal position. No abnormal sensations could be felt in the pancreas. No stones were palpated in the thickened adhesive gallbladder. Distally the bowel discoloration extended to the ileocecal junction but the color was fading in the lower ileal segments.

Realizing that only an extensive Whipple type operation with removal of the entire small intestine could hope to cope with the situation, and that the patient could not survive such an operation, an ileostomy was done to deflate the bowel and the abdomen was closed. The patient expired 15 hours later.

This case presents some very interesting facts, some unique, others that well agree with previous reports:

1. The pain of mesenteric thrombosis overshadows the physical findings.[10,12,14,23,25]

2. Although it cannot be certain when the onset of the thrombotic process began, it is equally uncertain that this may not have occurred in sublethal fashion at preceding times, as many authors record chronic and recurrent cases.[1,10,26] Wangensteen[28] states that "many cases run a fairly mild course, a week often elapsing before an abdominal lesion is suspected."[1]

3. The presence of blood recovered by suction from intestinal intubation has not been emphasized as a pertinent finding in mesenteric thrombosis. This finding might well be utilized as a diagnostic

aid for this condition. It may be of great help for an earlier diagnosis.

4. The most outstanding and unusual fact was the duodenal infarction. With the rich blood supply of the duodenum any vascular occlusion that involves its entirety must necessarily be extensive. In attempting to evaluate the actual mechanism we must assume this to have been a venous thrombosis. The insidious onset and the etiology, which we believe was cholecystitis, would favor a venous thrombosis.

Such a thrombus must involve a portion of the venous trunk that would accomplish such a result. Reviewing the venous drainage (fig. 3) such an occlusion must occur at or above the level of the entrance of the anteriorsuperior pancreaticoduodenal vein. This would of necessity, unless an anomalous condition existed, have occluded the right gastro-epiploic vein but there would still be good collateral circulation for the stomach. We should also expect to find the pancreas infarcted. It could well have been.

Another interesting speculation may be that there were previous sublethal occlusions with the development of a different collateral circulation. It is also conceivable that there may have been an anomalous circulation.

Again we would expect to find infarction along the entire course of drainage to the middle of the transverse colon. If this were an arterial occlusion such would probably have been found. There is a rich collateral of circulation between the superior and inferior mesenteric veins allowing the latter to handle the situation so long as this collateral was not obstructed. It is to be remembered that the inferior mesenteric vein empties into the splenic vein and would not have been involved by the occlusion.

In conclusion and summary we have reviewed the symptomalogy, pathology, diagnosis and prognosis of mesenteric thrombosis. A case has been presented of thrombosis with infarction of the duodenum which we believe to be the first record of such occurrence. Two important factors are emphasized:

1. The concept that mild thrombotic episodes are very frequent as may be demonstrated on any bowel that is acutely inflamed by infection or has been strangulated; and

2. The diagnostic factor of blood by suction from intestinal intubation.

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## SURGERY OF THE BILIARY TRACT

THE problems of biliary and pancreatic surgery are so closely interwoven that today the surgeon must be prepared to do pancreatic surgery if he anticipates doing biliary tract surgery. This principle must be recognized in the evaluation of the patient prior to operation, the evaluation of the operating room and blood bank facilities, and in the surgeon's honest evaluation of his own capabilities and limitations. If a surgeon anticipates operating on patients with acute cholecystitis, he must be qualified to suspect, rule out, or recognize acute pancreatitis. If he is to handle acute biliary tract problems, not only is his own proficency a prerequisite, but he must have access to a laboratory which provides pancreatic enzyme tests diagnostic of acute pancreatitis.

Similarly, it is seldom that a surgeon can operate with the assured diagnosis of a common duct obstruction secondary to a common duct stone. Instead, he must recognize the limitations of his diagnosis and realize that, diagnostically, he can go no further before laparotomy than to assure himself that the patient has a mechanical obstruction of the common duct. In assuming the responsibility of operation, the surgeon must then be prepared to explore the entire biliary tract, the pancreas, and the duodenum. He must be fully

cognizant of the many variations in the anatomical pattern of the bile ducts and hepatic arteries so that his dissection entails a minimal risk. Furthermore, unless he feels prepared to carry out major pancreatic and gastrointestinal resections, he may fail, on a high percentage of patients, in making a definitive diagnosis or in completing definitive operations. The surgeon who is not prepared to mobilize the head of the pancreas and to open the duodenum may pass up an opportunity to find a calculus impacted at the ampulla, an obstructing ampullary carcinoma or a chronic fibrosing pancreatitis. In the presence of obstructive jaundice, cholecystenterostomy may occasionally be the treatment of choice but what surgeon does not feel that he has done best by his patient when his operative decisions are based on an anatomical and etiological diagnosis?

Since disease of the duodenum and pancreas can so closely simulate disease of the biliary tract, it is essential that in order to do biliary tract surgery, the surgeon must be prepared to recognize diseases of the pancreas and duodenum and to extend the anticipated operation as dictated by his operative findings.

JOHN M. HOWARD, M.D.

# BOOK REVIEWS

*The Editors of* THE AMERICAN SURGEON *will at all times welcome new books in the field of surgery and will acknowledge their receipt in these pages. The editors do not, however, agree to review all books that have been submitted without solicitation.*

THE HINGE GRAFT. By ARNOLD K. HENRY. Arnold K. Henry, M.B., Doubl.; M. Ch. (Hon.), Cairo; F.R.C.S.I. Emeritus Professor of Clinical Surgery in the University of Egypt; Professor of Anatomy in the Royal College of Surgeons, Ireland. Baltimore, The Williams and Wilkins Company, 1950. 64 pp., 47 illus. $3.00.

This is an extremely interesting book which describes the surgical application of the mechanical principles for several orthopedic problems. As in all of Arnold K. Henry's writings, the subject is clearly described and the command of the English language is amazingly apparent. This makes for pleasant and enlightening reading.

Mr. Henry describes osteoperiosteal grafts removed from the tibia and used primarily behind flail joints to stabilize these joints so that motion is only possible in the desired plane; whereas, undesirable motion is eliminated. His work dates back to 1926 when he used the above principle in stabilizing paralytic calcaneo-valgus and drop feet.

He also describes the treatment of gross calcaneal fractures by molding these fractures and splinting posteriorly with hinge grafts to prevent the decrease of the tuber angle. He uses the same principle in his treatment for spastic flat feet to hold the keystone of the arch up and to preserve plantar and dorsiflexion. He has had three failures, all for paralytic club feet and on this type of deformity, he recommends the placing of the grafts in front of, rather than behind the malleoli. He describes the technic of treatment for genu recurvatum, and then deviates somewhat and describes a similar method of treatment for prehensile forearm stump and the replacement of finger skeletons by thinner osteoperiosteo grafts.

The choice of his descriptive term compares favorably with those used in his previous work and this recent volume should certainly be included in the library of every surgeon.

WILLIAM BONDURANT, M.D.

PEDICLE FLAPS IN PLASTIC SURGERY OF THE HEAD AND NECK. By GORDON B. NEW, M.D., F.A.C.S., Professor of Plastic Surgery, and JOHN B. ERICH, M.D., F.A.C.S., Associate Professor of Plastic Surgery. Both of Graduate School, University of Minnesota, and Section on Laryngology Oral and Plastic Surgery, Mayo Clinic, Rochester, Minn. Springfield, Ill., Charles C Thomas, Publisher. 104 pp.

This book is a monograph of 104 pages, printed on fine glossy paper of 6 in. by 9 in., and is well illustrated by numerous drawings and photographs.

The book presents the subject in clear, concise terms based on the personal experience of the authors in the plastic surgical department of the Mayo Clinic. The subject matter includes a review of pedicle flaps in general, including the usage of such flaps, and the types of flaps. In considering flaps about the head and neck it considers in detail the factors concerned in the choice of a flap. Concise instruction is given for each type of flap as to the method of elevation, delay, and transplantation with suggested time intervals. Lastly, it con-

siders in some detail the flaps best suited to defects of the various areas of the head and neck.

It is a "detailed concise" book in that it is very inclusive, yet specific with no superfluous explanations and descriptions. It is intended for the plastic surgeon and for the prospective plastic surgeon in his residency, and is to be highly praised as a ready reference book for the specialist.

JOHN R. LEWIS, JR., M.D.

INDICATIONS FOR AND RESULTS OF SPLENECTOMY, by FREDERIC A. COLLER, M.D., ALEXANDER BLAIN III, M.D., and GOULDE ANDREWS, M.D., from the Departments of Surgery and Medicine, University of Michigan Medical School, Ann Arbor, Mich. Publication No. 86. The American Lecture Series. A Monograph of the American Lectures in Surgery. Springfield, Ill.: Charles C Thomas, Publisher, 1950. 100 pages. $2.25.

This monograph is No. 86 in a series edited by Michael D. DeBakey, M.D., and R. Glen Spurling, M.D., and deals with the spleen and the conditions which are treated by its removal as well as the results from the operation. It is written by well qualified authors using the material collected in a 15 year period ending in July, 1949 and, while not a truly outstanding writing, is very good.

The volume begins with a general consideration of the physiology of the spleen and the effect of the splenectomy on the body as noted in the study of 204 patients in the author's series. In a methodical manner, a brief study is made in each disease which necessitates splenectomy. The monograph is ended by a few comments on the technic of splenectomy, the finding of accessary spleens and finally a summary and conclusion.

This is a very nice small volume and our greatest criticism is the brevity with which it treats the diseases. Of course, it was understood that it was the aim of the author to present a compact, authoritative monograph on the subject of splenectomy, but it is our hope that they will expand this foundation into a volume with attention to detail.

This is a very worth-while monograph to physician and surgeon alike.

A. H. LETTON, M.D.

SURGERY: ORTHODOX AND HETERODOX, by SIR WILLIAM HENEAGE OGILVIE, K.B.E., D.M., M.Ch., F.R.C.S., Hon. F.A.C.S., Hon. F.R.C.S. Canada, Hon. F.R.A.C.S., Member of the Council of Royal College of Surgeons; Surgeon, Guy's Hospital and Royal Masonic Hospital. Springfield, Ill.: Charles C Thomas, Publisher, 1950. 241 pages. $4.00.

This is a collection of the less technical addresses of a very famous British Medical Philosopher, a man who was unmistakably a surgeon. This is relaxing, enjoyable reading for surgeons for it expresses so nicely ideas, ideals, feelings, and emotions that we are constantly experiencing, that we may or may not have revealed to others and maybe not even to ourselves.

The first few chapters are particularly good. The author's first chapter entitled "Religio Chirurgi" deals with why he chose to be a surgeon. He contrasted the practices of surgery and medicine as an occupation, pointing out the optimism, the cheerfulness, the happiness which must and does prevail throughout the practice of surgery. This is due for the most part to the fact

that surgical patients were healthy individuals whose life is interrupted by some crisis. Also the course of action in surgery is clear; the treatment definite and immediate, as contrasted with the medical wards with their sunken eyes, pale cheeks, where the words are cheerful and laughter does prevail, but neither rings true. He concludes the chapter by saying, "Surgery may not require brains or bring a fortune but it is the best job in the world."

The volume takes its name from the second chapter which deals with the old struggle of orthodoxy and heterodoxy—shall we adhere to the approved or shall we occasionally wander in the hope of finding something better?

In this manner the volume deals with many non technical subjects as well as some less technical subjects. The writing, typically British, is quite concise and effective. This volume will be welcomed by all surgeons and is to be read when one has been slightly overworked and is rather proud of the field of surgery. The binding does not seem too sturdy but the printing is good, easily readable and is on moderately rough paper.

A. H. LETTON, M.D.

CURRENT THERAPY 1951. Edited by Howard F. Conn, M.D., Philadelphia, W. B. Saunders Co. 699 pages. $10.00.

This year's volume of "Current Therapy" actually has a few pages less than last year's volume, but there are included many new features and, because of the slightly smaller size print, there must be many more words in the volume. Forty-nine new contributors have been significantly changed. A list of contributors looks almost like "Who's Who in American Medicine." To mention only a few of this host of medical authorities, there are Arnold Bargen, Elmer Bartels, Paul Beeson, Warren Cole, George Crile, Jr., Robert Greenblatt, Roy Kracke and George Pack. It is interesting to compare the index this year with last year's index—we notice for instance that in 1950 there were three references to Cortisone while in 1951 there are 12. This is mentioned only to show how up-to-date the volume is being kept.

All of these articles are written in a scholarly manner, and they have been well edited. In the articles the diagnosis is not discussed, but the treatment is discussed in detail, while leaving out the physiological pathology and pharmacology. Whenever there is a choice of methods to use, the various methods are outlined. There is no editorializing, and the individual is left to his choice of the methods of treatment.

An added feature this year is a roster of drugs which describes many of the more commonly mentioned drugs in detail, tells how they are supplied and what pharmaceutical company makes them. There is also a conversion table of weights and measures which should come in handy.

This is an excellent book for the practicing physician's desk where he may turn to the volume in prescribing for a disease, the current treatment for which he may not have had an opportunity to learn. Since the subjects of medicine and surgery have grown by leaps and bounds in the past few years, it certainly behooves all of us not to rely too much on our memory, and it serves our patients quite well that we check up on ourselves as to what is the most up-to-date method of treatment.

A. H. LETTON, M.D.

# ABSTRACTS FROM CURRENT LITERATURE

THE INFLUENCE OF VARYING SUBCALORIC DIETS ON NITROGEN LOSS AND RECOVERY FOLLOWING STANDARDIZED SURGICAL TRAUMA. Morton D. Pareira, J. G. Probstein, and Michael Momogyi. *Surgery, Gynecology and Obstetrics 92*:90-94 (Jan.) 1951.

In view of the well-known untoward consequences of hypoproteinemia in the postoperative state and the obstacles to nitrogen utilization, the question may be raised as to whether or not the administration of amino acids in many of the postoperative states is indicated at all. The possibility that it may be harmful rather than useful must not be disregarded. Since intravenous alimentation is almost invariably subcaloric, the body is forced to use the amino acids as fuel thus imposing strain upon the metabolic mechanism. The studies presented herein were performed on dogs with the purpose of evaluating the administration of amino acids in subcalorid dietary regimens in the immediate postoperative state.

Two healthy parasite-free dogs were used and were fed on a standardized balanced diet for a period of three months in order to thoroughly stabilize their nitrogen balance. They were then fed for standard periods on a succession of standardized diets in this order: maintenance diet, starvation, "adjustment" diet, maintenance diet again, carbohydrate only, adjustment diet, maintenance diet, carbohydrate-amino acid, adjustment diet. This routine was repeated and at the onset of the starvation period, a standardized laparotomy was performed. Careful records were kept of nitrogen intake, nitrogen loss (calculated on the presumption that urinary nitrogen loss represents 90 per cent of the total loss), and body weight at the end of each period. These results are clearly presented in tabular form. On the basis of these observations, the authors are able to make the following conclusions:

"1. Dogs on subcaloric diets in the post-traumatic (surgical) state lose but slightly less body nitrogen when fed on carbohydrate and amino acids in equal amounts than when fed on isocaloric amounts of carbohydrate alone.

"2. Whereas the difference in body nitrogen loss under the two conditions is small, restitution of nitrogen balance occurs much faster following feeding of carbohydrate alone than after carbohydrate-amino acid feedings. This is true in both the intact and postsurgical conditions.

"3. Body weight loss is less, whether or not preceded by surgical trauma, with carbohydrate feeding than with carbohydrate-amino acid feedings under conditions of these experiments.

"4. Carbohydrate, it appears, exerts a specific favorable effect on the preservation of total metabolic functions of the body."

R. H. S.

FELTY'S SYNDROME. REPORT OF TWO CASES TREATED BY SPLENECTOMY. Edmund A. Kanar, Henry N. Harkins, Richard I. Crone, Clinton S. Lyter, Albert H. Robinson. *Western Journal of Surgery, Obstetrics and Gynecology 58*:670-681 (Dec.) 1950.

Felty's syndrome, the essential features of which are rheumatoid arthritis, splenomegaly and leukopenia, has been thought to constitute a definite entity but this has been doubted in recent years. Its response to splenectomy parallels the results of splenectomy in splenic leukopenia. The authors were able to

find 18 reported cases in the literature of Felty's syndrome treated by splenectomy and, while improvement is sometimes only temporary, some improvement is noted in all cases.

Herein are reported 2 additional cases. Both of these patients showed definite, sustained hematologic improvement following removal of an enlarged spleen. There was no significant change in the status of the rheumatoid arthritis in either patient. These cases have been followed 20 months and five months respectively. The follow-up studies will be continued.

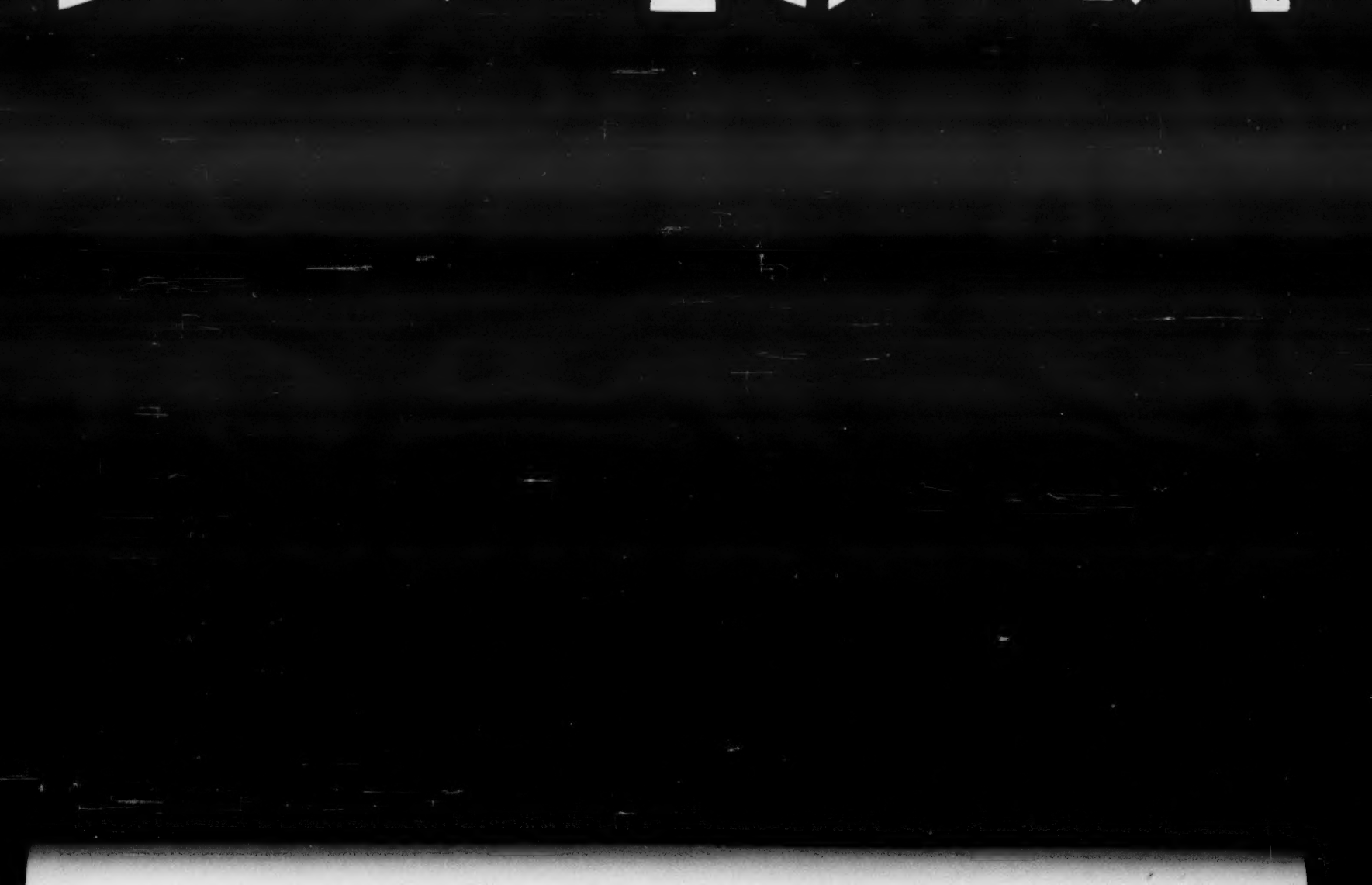
The authors conclude that while the part played by the spleen in the diminution of the leukocytes in Felty's disease is not understood, the basic mechanism causing blood deficiencies in this syndrome and in primary splenic neutropenia are possibly identical.

R. H. S.

GELFOAM AND THROMBIN IN TREATMENT OF MASSIVE GASTRODUODENAL HEMORRHAGE. A PRELIMINARY REPORT. Meyer O. Cantor, Charles S. Kennedy, and Roland P. Reynolds. *American Journal of Surgery 80*:883-887 (Dec.) 1950.

Cantor and his coworkers herein report a series of 28 patients treated for massive gastrointestinal hemorrhage with Gelfoam and thrombin and, in an addendum, state that they have since this paper was prepared treated an additional 46 cases. One of the patients was operated upon and died. Thus they are able to report a total of 73 cases without a death in the medically treated group.

Upon admission, adequate blood replacement is instituted. The patient is placed on a Meulengracht diet, antacid therapy, sedation and bed rest as is usual in the conservative management early in the disease. In addition the patient is given 2 teaspoonfuls of powdered Gelfoam in 2 oz. of milk and cream and this is followed immediately by 250 units of thrombin in 50 cc. of water. This routine is repeated every two hours.

The authors conclude that, though the evaluation of the efficacy of hemostatic agents in gastrointestinal bleeding is difficult, because of the marked reduction in mortality rate being reported as a result of a rigid medical routine, the use of Gelfoam and thrombin appears to be a useful addition to the armamentarium.

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